ABSTRACT

Title of Dissertation: RESILIENCE TO CLIMATE CHANGE: AN ETHNOGRAPHIC APPROACH

Katherine Joanne Johnson, Doctor of Philosophy, 2016

Dissertation directed by: Professor Michael J. Paolisso
Department of Anthropology

Global projections for climate change impacts produce a startling picture of the future for low-lying coastal communities. The United States' Chesapeake Bay region and especially marginalized and rural communities will be severely impacted by sea level rise and other changes over the next one hundred years. The concept of resilience has been theorized as a measure of social-ecological system health and as a unifying framework under which people can work together towards climate change adaptation. But it has also been critiqued for the way in which it does not adequately take into account local perspective and experiences, bringing into question the value of this concept as a tool for local communities. We must be sure that the concerns, weaknesses, and strengths of particular local communities are part of the climate change adaptation, decision-making, and planning process in which communities participate. An example of this type of planning process is the Deal Island Marsh and Community Project (DIMCP), a grant funded initiative to build resilience within marsh ecosystems and communities of the Deal Island Peninsula area of Maryland

(USA) to environmental and social impacts from climate change. I argue it is important to have well-developed understandings of vulnerabilities and resiliencies identified by local residents and others to accomplish this type of work. This dissertation explores vulnerability and resilience to climate change using an engaged and ethnographic anthropological perspective. Utilizing participant observation, semi-structured and structured interviews, text analysis, and cultural domain analysis I produce an in-depth perspective of what vulnerability and resilience means to the DIMCP stakeholder network. Findings highlight significant vulnerabilities and resiliencies inherent in the local area and how these interface with additional vulnerabilities and resiliencies seen from a nonlocal perspective. I conclude that vulnerability and resilience are highly dynamic and context-specific for the local community. Vulnerabilities relate to climate change and other social and environmental changes. Resilience is a long-standing way of life, not a new concept related specifically to climate change. This ethnographic insight into vulnerability and resilience provides a basis for stronger engagement in collaboration and planning for the future.

RESILIENCE TO CLIMATE CHANGE: AN ETHNOGRAPHIC APPROACH

by

Katherine Joanne Johnson

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2016

Advisory Committee:

Professor Michael J. Paolisso, Chair
Dr. Christine Baumann Feurt
Research Professor Shirley Fiske
Associate Professor Brian Needelman
Assistant Professor L. Jen Shaffer

ACKNOWLEDGEMENTS

To the Department of Anthropology, College of Behavioral and Social Sciences, and Graduate School at the University of Maryland as well as the NSF funded National Socio-Environmental Synthesis Center: I acknowledge and appreciate the significant financial resources given that have enabled my pursuit of the Ph.D.

To local residents of the Deal Island Peninsula area and the stakeholder network of the Deal Island Marsh and Community Project: thank you for sharing and allowing me to be a meaningful part of our collective struggle with our changing world.

To Christine Miller Hesed and Elizabeth Van Dolah: I am grateful for your gracious skill and assistance in key areas of data analysis and manuscript preparation.

To Donna Harris and John Johnson: thanks for being my longest-running supporters! You have each in your own very different ways contributed significantly to my development and achievements—I could not have done it without you.

And finally to the many other friends and loved ones who have encouraged me to follow my interests and persist in my efforts I am forever indebted to you and am happy to return the favor any time you need. A special thank you to Arnoud Moes, Diane Johnson, Maggie Belous, Julie Vastine and Jennifer Allen.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CL	collaborative learning
CRP	collaborative research projects
DIMCP	Deal Island Marsh and Community Project
EPA	United States Environmental Protection Agency
IPCC	Intergovernmental Panel on Climate Change
MBR	Monie Bay National Estuarine Research Reserve Component
MD	Maryland
MD-DNR	Maryland Department of Natural Resources
NERRS	National Estuarine Research Reserve System
NOAA	National Oceanic and Atmospheric Administration
OMWM	open marsh water management
SHI	Skipjack Heritage, Inc.
SESF	social-ecological systems framework
TMDL	total maximum daily load
UMD	University of Maryland

Chapter 1: Introduction

Impacts from climate change, both current and anticipated, will affect physical, ecological, social, economic and political sectors of life for communities around the globe. Maryland's rural coastal areas are no exception, and in fact the U.S. Mid-Atlantic region and the Chesapeake Bay will be more greatly impacted by sea level rise than other areas of the country (Spanger-Siegfried, Fitzpatrick, and Dahl 2014). For local communities, threat is imposed by the immediate physical changes spurred by global weather patterns and bio-physical processes, as well as the secondary effects of these and broader systemic changes produced by climate change (Pelling 2011). As communities move towards and are involved in government supported adaptation planning activities, I argue it is important to have well-developed understandings of vulnerabilities and resiliencies identified by local residents and others engaged in this type of work. This dissertation research investigates the position of social-ecological system representatives with regard to climate change and the implications this has for future adaptive capacity.

The Deal Island, MD area is a low-lying and rural coastal area adjacent to the Tangier Sound of the Chesapeake Bay (see Figure 1 for map). The Chesapeake Bay is our nation's largest estuary with a contested history of environmental management, conservation, and pollution regulation (Horton 2013; Ernst 2003). For ease of reference, Deal Island, MD and nearby communities are referred to as the Deal Island Peninsula. In addition to four small communities, the marsh-dominated landscape also has a large proportion of state and federally managed wildlife and conversation lands. A fuller description of the local community, environment, and the Project will

be included in later chapters. The Deal Island Marsh and Community Project (DIMCP) promotes scientific investigation and community collaboration to build resilience to climate change for the Deal Island Peninsula area. This National Oceanic and Atmospheric Administration (NOAA) grant-funded project provides an important opportunity to investigate vulnerabilities and resiliencies to climate change on a local level and to utilize these understandings to inform resilience planning and vulnerability mitigation into the future. The DIMCP has convened local community members, environmental managers, academic researchers, and local non-profit and governmental representatives to work collaboratively on expected climate change impacts such as flooding, erosion, and sea level rise.

Global effects from climate change and future projections of change are becoming better understood through the work of the Intergovernmental Panel on Climate Change (IPCC). Their 2014 report gives evidence of past surface temperature warming, ocean warming, ocean acidification, melting ice sheets and glaciers, and global sea level increase due to increased levels of greenhouse gases (IPCC 2014, 2-4). Perhaps most concerning in this case, sea levels are projected to increase for 95% of coastal areas, and may rise as much as .82 meters by 2100 (IPCC 2014, 13). Nearly a truism, anthropologists have stressed that climate change is a global problem, but one that is experienced locally by communities and individuals (Fiske et al. 2014, 72; Crate 2011; Roncoli, Crane, and Orlove 2009). Climate change does not mean the same thing to everyone nor will it cause the same negative impacts everywhere. Projected and documented impacts specific to the Chesapeake Bay region include increased carbon dioxide, water temperatures, storm severity, flooding, and erosion

(Eggleston and Pope 2013; Maryland Department of Natural Resources 2008; Najjar et al. 2010). As the average elevation of the Deal Island Peninsula area is less than one meter, dramatic impacts are expected across both its ecological and social systems.

Understanding the Deal Island Peninsula area as a robust social-ecological system is important, as it highlights features of and interactions between the natural environment and human communities. Social-ecological systems theory has grown out of the ecological sciences to better position ecosystems as incorporating human inhabitants and influences (Folke, Colding, and Berkes 2002). Social-ecological systems theories tend to focus on ecological realities such as feedback loops, unexpected results, and pathways between systems components to explain system dynamics (Walker and Salt 2006). In agreement with Crane 2010, I view social-ecological systems as a tool, a heuristic, for reducing complexity and relations despite a broadened scope of focus. In this dissertation, I utilize social-ecological systems thinking as a foundational orientation to highlight concerns beyond the ecological system of the Deal Island Peninsula area alone. Ethnographic exploration of vulnerability and resilience help to focus investigation.

Vulnerability and resilience are two well established categories employed to discuss and clarify strengths and weaknesses individuals, communities, ecosystems, or social-ecological systems face regarding change and perturbation (Ogden et al. 2013; Füssel and Klein 2006; Janssen et al. 2006; Janssen 2007). Resilience, in particular, has been used as an analytic tool for evaluating social-ecological systems (Folke 2006; Walker and Salt 2012). Vulnerability and resilience have multiple

definitions and meanings and are used in diverse ways across academic disciplines and practitioner communities (Kelman, Gaillard, and Mercer 2015; Young 2010; Preston, Yuen, and Westaway 2011). In most cases, the literature conceptualizes vulnerability and resilience using theory defined by researchers or scientists rather than local residents and community members (Amundsen 2012; Nelson, Adger, and Brown 2007; Turner et al. 2003; Kelly and Adger 2000). However, change also needs to be interpreted through knowledge embedded in local communities, and understood as influenced by global discourse, understandings, and theorization (Adger et al. 2013; Hulme 2008; Rudiak-Gould 2011). This means that embedded cultural and environmental knowledge concerning the vulnerabilities and resiliencies of a particular social-ecological system may not closely match the theoretical constructs found within academic literature. A mismatch in the way vulnerability and resilience are understood at a local and regional scale can produce potentially confusing or negative outcomes for local communities (Adger et al. 2013). And researchers have critiqued the application of the resilience framework for evaluating social-ecological systems as insufficiently accounting for social systems dynamics such as agency and power (Cote and Nightingale 2012; Fabinyi, Evans, and Foale 2014). Fabinyi, Evans, and Foale (2014) have argued that more emphasis is needed on contestation and power particularly relating to the empirical or lived experience of people's lives (7).

To better understand these social dynamics and local interpretations of vulnerability and resilience, I utilize a multi-sited and engaged environmental anthropology approach informed by research in the fields of cultural, climate change and environmental anthropology. This approach utilizes traditional anthropological

practice such as participant observation and interviewing (DeWalt and DeWalt 2002) but pairs it with a focus on embedded and cross-system vulnerabilities and resiliencies. Involvement in the DIMCP has allowed significant interaction with locals, academics, environmental mangers and others engaged in project activities. As such, this dissertation represents a non-traditional ethnographic engagement within a stakeholder network formed by the DIMCP rather than within a community or localized group of people. Here, ethnographic inquiry can provide fuller coverage at the confluence of local and regional scales to improve understanding of vulnerability and resilience to climate change.

This dissertation is built upon the social-ecological system of the Deal Island Peninsula with an eye towards understanding stakeholder's knowledge of vulnerability and resilience to climate change. The DIMCP has produced a stakeholder network with diverse interests across the social-ecological system and commitment to building resilience to climate change. Knowledge embedded within this network provides the core data for research. Where possible, additional information has been provided to help augment and embed stakeholder knowledge in relevant contexts. My goal is to develop a multifaceted view into the problem of climate change for the Deal Island Peninsula area. Information presented here will enable the reader to understand how climate change impacts emerge in different ways across the social-ecological system, and how these impacts are differentially interpreted by local residents and nonlocal stakeholders, and to a lesser extent project leadership and environmental management.

This work is significant in its attempt to bring together complex issues and enhance both empirical and conceptual clarity to better define what resilience to climate change means for the Deal Island Peninsula area. Because of my focus is at the level of the social-ecological system rather than only the local population, and because I am interested in perspectives of resilience and vulnerability from the "ground up" rather than from the "top down," I have set out to cover a lot of territory. Both the Deal Island Peninsula area and DIMCP are dynamic and changing entities faced by climate change—a dynamic force of environmental and social change. Tracing resilience through the Deal Island Peninsula area and the DIMCP require knowledge from environmental and climate change anthropology, as well as literature on vulnerability, resilience, and social-ecological systems. In turn, the production of insights related to vulnerability and resilience within the Deal Island Peninsula area can contribute to these bodies of literature, and build upon anthropological theorization of resilience to climate change.

Overview of Dissertation

This dissertation is an ethnographic and social-ecological study of vulnerability and resilience to climate change focused on the Deal Island Peninsula area of Maryland, a rural coastal community on Maryland's eastern shore of the Chesapeake Bay (regionally known as the Eastern Sore). Chapter 1 has introduced several foci of the dissertation including: climate change, engaged environmental anthropology of climate change, the Deal Island Peninsula area, the DIMCP, social-ecological systems, and vulnerability and resilience. Key questions answered through this dissertation include: What are the strengths and weaknesses within the Deal

Island Peninsula area that will influence the way impacts from climate change are felt? Are there important differences between the local and nonlocal viewpoints on vulnerability and resilience? And, what key takeaway messages can we develop related to vulnerability and resilience investigated in this ethnographic manner?

In Chapter 2, I provide information on the Deal Island Peninsula area, concentrating on its history, landscape and environment, and communities. This second chapter gives general insight into how the area's communities have formed, and outlines important features of the economy and livelihood practices influential to past and current residents. More importantly though, this chapter provides a description of local communities and demonstrates the diversity of interests even within this small population. My goal for this chapter is to develop sense of place for the reader so that as new information is introduced it can be contextualized interpreted appropriately.

Chapter 3 introduces the topic of climate change and outlines the anticipated consequences of both global and local impacts. In addition, I discuss important aspects of environmental management and governance that extend across global, regional, and local levels that have implications for how climate change response occurs for the Deal Island Peninsula area. The chapter closes with a brief description of local resident's views regarding climate change. This chapter also summarizes the threats from climate change and provides important background information for thinking about the specific vulnerabilities and resiliencies identified by DIMCP stakeholders and introduced later in the dissertation.

In Chapter 4, I define the mechanisms through which I have become involved with the Deal Island Peninsula communities and Deal Island Project stakeholder network. Here, I discuss engaged environmental anthropology as a tool for community interaction and engagement. This is paired with information on the origins and objectives of the DIMCP. In addition, I have included a discussion of the project's guiding frameworks: collaborative learning and collaborative science and the DIMCP stakeholder network. Together, information on the DIMCP and engaged environmental anthropology provide important perspective on the interaction between myself, project researchers, and DIMCP stakeholder participants and local community members.

Chapter 5 is dedicated to describing theoretical frameworks that inform and guide this work. These include: the anthropology of climate change, social-ecological systems, and several theories of resilience from the literature. Resilience provides the key motivating concept for the dissertation and for the DIMCP. Building resilience to climate change is the project's objective, but understanding how resilience is understood and utilized across the DIMCP stakeholder network is the primary research focus of this dissertation. Social-ecological systems theory provides a useful model for structuring cross-system understandings and interactions. Because these bodies of theory are not traditional within anthropology, I have also included insights from the anthropology of climate change to ground my application of resilience and social-ecological systems theory. Together, these three theoretical frameworks enable me to produce a unique perspective on resilience to climate change in social-ecological systems.

The focus of Chapter 6 is to outline the research methodologies used to conduct this dissertation work. The first organizing methodological framework is multi-sited ethnography. I then focus on the techniques of participant observation, semi-structured interviewing and text analysis, cultural domain analysis, and structured interviewing. Each method of research is explained with reference to the relevant literature and described in terms of how it is applied to investigate DIMCP stakeholder views. Findings from each research method are discussed later in the dissertation. The methods are closely tied to the broader work of the DIMCP, but also provide additional perspective on the scope of the project activities.

Chapter 7 and 8 are devoted solely to local Deal Island Peninsula area resident's views of vulnerability and resilience to climate change. Their quotes and insights are used to define eight vulnerabilities and eight resiliencies that they experience in their area. While my guiding interest is in defining resilience for the overall social-ecological system, focused attention to local resident's perspectives helps to ground understandings of vulnerability and resilience within the broader Deal Island Peninsula area.

In Chapter 9, I develop a fuller understanding of both vulnerability and resilience in the context of the Deal Island Peninsula area by introducing understandings from nonlocal DIMCP stakeholders. Adding additional data and knowledge from nonlocal stakeholders enhance the views of vulnerability and resilience gained in Chapters 7 and 8, and highlights the ways that locals and nonlocals tend to understand vulnerability and resilience differently.

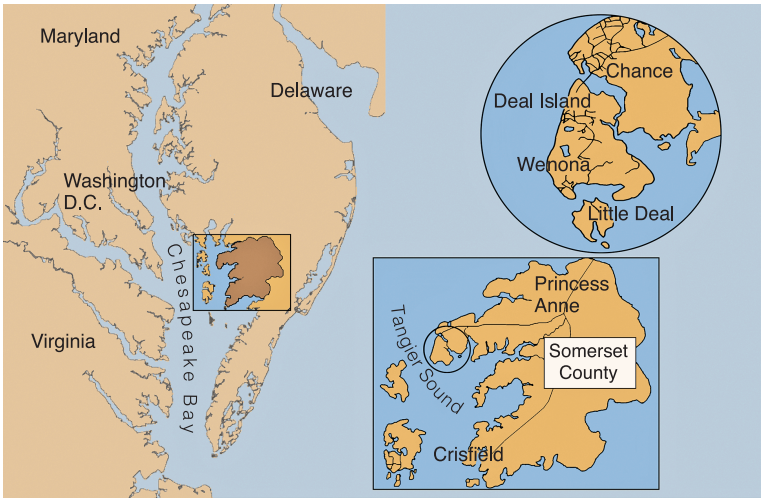
These three chapters (7-9) set the stage for Chapter 10, where I return to the level of the social-ecological system to create a more comprehensive view of resilience to climate change, and discuss stakeholder network level data. This chapter focuses on how vulnerability and resilience relate to one another. It also develops understanding of the range of options for combating vulnerability and building resilience in which DIMCP stakeholders are interested. Together, this information provides a comprehensive view of how vulnerability and resilience are defined, how they relate to one another, and some initial insights into the ways that stakeholders themselves would prioritize future work of the DIMCP.

Chapter 11 ties together insights from the dissertation, providing a summary of key points on vulnerability and resilience. Findings indicate vulnerability should be understood not as the product of physical environmental threats, but as a dynamic and variable concept driven by both social and ecological concerns among DIMCP stakeholders. Resilience is an even more complex concept and reality closely tied to adaptive capacity. For locals, resilience is built on their historic relationship with the area, and stems from their ability to adapt and maintain their way of life. Nonlocal stakeholders have helped introduce resilience by building links to the outside and introducing new ideas. In both cases, resilience is a positive concept that helps people across the social-ecological system begin thinking about ways forward in the future. The dissertation argues vulnerability and resilience should be considered together, that diverse perspectives are important, and that the social-ecological systems perspective is a useful framework for organizing this information.

Chapter 2: Living on the Deal Island Peninsula

The Deal Island Peninsula extends into the Tangier Sound of the Chesapeake Bay and is situated in Somerset County, Maryland (MD) (see Figure 1). The six by three square mile area (actually a peninsula and series of islands) is low-lying and dominated by tidal waterways and marsh grass, interspersed with several rural communities, the largest of them being Dames Quarter, Chance, and Deal Island, MD. Other smaller communities nearby include: St. Stephens, Oriole, Monie, and Wenona. The combined population of these areas in about one thousand people (U.S. Census Bureau 2015). The nearest town, Princess Anne, has a population of just over three thousand and is the county seat (U.S. Census Bureau 2015). The area has a long and rich history. Settled early in the colonial era, the natural environment has played an important role in determining the efforts and spirit of the people (Lefferts 1918).

Figure 1: Location of the Deal Island Peninsula Area



Credit: iStock.com/crossroadscreative and Maryland Sea Grant

While fully enmeshed in its regional and modern context, being only 15 miles from the county seat and 150 miles from Washington, D.C., the Deal Island Peninsula area is also set apart by its geography and history. Vast marshes and quaint communities reflect simpler times and moving through them highlights a uniqueness found in the Chesapeake region (Warner 1977; Wennersten 1992; Paolisso 2005). The character of this place is a direct result of its reliance upon the water, regional politics that have left it largely undeveloped, and trajectories of social and economic influence that have contributed to an identity of independence. Over the next one hundred years impacts from climate change are likely to be dramatic—much more so than changes experienced in the past century. Before presenting information on climate change and environmental management, this chapter develops the history of the area, a description of the natural environment, and insight into the contemporary communities. This information introduces the reader to a base of knowledge for the Deal Island Peninsula area to build upon before more detailed coverage of climate change, engagement, theory, and method are given in subsequent chapters.

History

The Mid-Atlantic region of North America has a temperate natural environment enabling agriculture while the Chesapeake Bay's protected and shallow waters make it a rich and accessible fishing area (Lefferts 1918; Lippson and Lippson 2006). European settlers displaced the original inhabitants following John Smith's famous exploration of the Chesapeake Bay. The area once supported populations of Native American Indians that were confined to reservations and afterward steadily declined in population (Radoff 1971). The history of the Deal Island Peninsula area

begins here, with written records that give a sense of the ways in which people subsisted and used the land and water through time to the present.

Gregory Stiverson, Assistant State Archivist for Maryland in 1977, argues that early settlement to Maryland's lower Eastern Shore was driven primarily by the Quaker expulsion from Virginia in 1660 (Stiverson 1977). The earliest land titles for Devil's Island (what Deal Island was known as until the 19th century) record large tracts for cattle grazing of marsh forage. By 1677, the best agricultural and grazing lands were patented, with only two percent under cultivation. Population numbers remained low and only five landowners (three of whom were also slave owners) and twenty-six slaves are recorded in 1783 on Devil's Island (Stiverson 1977).

Preceding the American Revolutionary War and just afterward, the Reverend Francis Makemie established churches in Somerset County and converted thousands to Presbyterianism (Stiverson 1977; Mullikin 1971, 153). At that time, Methodist preachers were also active in the area and arrested for supporting the British cause. Despite this, their reach and popularity grew—perhaps because of their dramatic flair for preaching even while incarcerated (Stiverson 1977). By 1781, formal organization of a Methodist church had begun on Devil's Island (Stiverson 1977). The influence of Methodism even induced several slave owners to manumit their slaves prior to 1790 (Stiverson 1977). Methodism had taken root and would play an increasingly important role in Deal Island area communities into the future.

The late 1700's saw tremendous upheaval and change for the colonies and the fight for independence divided Eastern Shore residents. Loyalists were numerous in Somerset and Worcester counties (Mullikin 1971, 154) and Stiverson reports that

insurrections in Somerset and Worcester Counties compelled the State to request Federal troops. A letter from State of Maryland records dated July 1776 indicates troops were stationed at "Dammed Quarter" (what became Dames Quarter, MD) (Browne (1776) 1893, 144). A local newspaper clipping indicates a forgotten fort found in 1916 in the Dames Quarter area that could be related to these events (Appendix A). The same clipping dates the settlement of Dames Quarter even earlier than Deal Island, to 1645. A local genealogist maintains that Dammed Quarter was named after a 1666 patent for 150 acres (Polk 2000). These early clues are sparse, but give a picture of a slowly developing area, lightly populated and dependent upon nature's bounties.

After the American Revolution, an attempt at independent statehood was made on Maryland's Eastern Shore (Mullikin 1971, 155). It failed, but the state constitution did allow for localized government offices so a separate and equal government structure was set up in Talbot Town (which became Easton, MD), and served as the unofficial capital of the Eastern Shore until after the Civil War (158). By then, improved transportation and communication enabled government oversight to be returned to Annapolis (158). Communities across the region were reliant upon the water for all travel, trade and news as very few inland routes were navigable until the middle 1700's when roads and ferries became more common (153). Yet roads were generally of poor condition and horseback was the principal mode of locomotion meaning communities were far more separate from each other than today (157). Nearby Princess Anne was established as the county seat by 1733 (153) but

according to Mullikin, the Eastern Shore remained remarkably insular until the late 1800's as people were reluctant to travel to major city centers (Mullikin 1971, 157).

Stiverson (1977) gives evidence that the progenitors of many well-known families in the Devil's Island area had settled there by the turn of the nineteenth century. As population increased and people could not be supported through agriculture alone, islanders provided canoes and sailors for transporting tobacco and grain up and across the Chesapeake Bay and the vegetables grown locally were marketed to customers along the way (Stiverson 1977). Based on records of modest household assets, Stiverson asserts that "love for the water and the waterman's way of life" (rather than accumulation of wealth) motivated the local population. Seafood harvesting and processing industries developed in the 1800's (Roberts 1905; Lefferts 1918). These resource extractive opportunities were the lifeblood of the Deal Island Peninsula area's small communities, but also tied them to regional economic and political networks. Oyster harvesting on the Chesapeake Bay was of primary economic importance. By 1820 Maryland banned dredging to dissuade nonlocals from oyster harvesting in the Bay and protect this local economic resource. Oysters continued as an economic mainstay of local watermen who marketed their bounty in Baltimore (Stiverson 1977).

The Deal Island Peninsula area is significant in the history of the United Methodist Church. It was the site of well-known and annual revivals in the middle 1800's and home to famous pastors including Lorenzo Dow and Joshua Thomas (Stiverson 1977). Thomas, in particular, is well regarded and for whom the area was added to the National Register of Historic Places in 2006 (Wallace 1861; American

Dreams 2016; Rhodes 2007). In 1813 and 1814 Eastern Shore towns organized militias to defend against British occupancy during their assault on the Nation's capital (Mullikin 1971, 156). Area residents did host British troops, but when Joshua Thomas, "parson of the islands," was ordered to preach to the British fleet before their attack on Baltimore, he warned them that God had foretold their failed attack, and indeed they did not succeed (Mullikin 1971, 156; Stiverson 1977). From 1828 until 1922, Methodist camp revival meetings were held annually in August on Devil's Island, with thousands from around the Chesapeake Bay area in attendance (Stiverson 1977; Wheatley 2004). Methodist ministers were instrumental in dropping the "v" from Devil's Island, and for some portion of the 1800's the area was known as "Deil's Island" before becoming "Deal Island" (Stiverson 1977).

From the late 1800's to the 1930's steamboats docked off of Deal Island on their routes from Baltimore to Norfolk, transporting cargo and passengers (Lefferts 1918). This was the heyday of steamer transportation (Mullikin 1971, 159). By 1830 most towns in the area were linked to Baltimore by steamboat (Mullikin 1971, 157). However, that would change in 1835 when the Eastern Shore Railroad Company was authorized to build a rail line from Elkton, MD to Somers Cove on the Tangier Sound (what would become Crisfield, MD) (Mullikin 1971, 157-158). After the Civil War and by 1900, Crisfield quickly grew to become one of the four most populous cities on the Eastern Shore, and of well-known importance to the seafood industry (Mullikin 1971,159). Without steamboats, the Deal Island Peninsula area would be entirely devoid of large-scale transportation, as the railroad never came to the area (Lefferts 1918, 53). Pushing for more localized independence, from 1830-1850

multiple attempts at Eastern Shore succession were made but failed (Mullikin 1971,157). Soon thereafter, the American Civil War pushed the region into turmoil.

Encampments of Northern soldiers were stationed close to important towns and county seats in the region to ensure peace and allegiance to the Union during the Civil War (Mullikin 1971,157). Many Marylanders sympathized with the Confederacy and some left to join the Confederate Army. While the populace of Maryland was divided in its allegiances Stiverson reports that in an 1862 census of Deal Island, MD only one out of 160 men was under arrest by military authorities for supporting the Confederate cause—suggesting the local majority backed the Union cause. As an aside, all but twenty-seven of the men recorded in this census identified as watermen (fishers and catchers of seafood) and the rest registered in industries supporting them with goods and services, which suggests the primacy of this industry by the middle 1800's (Stiverson 1977). Regiments from Maryland, including representatives from Somerset County, fought at Gettysburg and other important battles of the Civil War (Mullikin 1971, 158).

While other areas of the Eastern Shore were discovered and popularized through travel writing in the 1870's (Mullikin 1971, 158), the Deal Island area dwindled in importance for Methodist camp revivals (Mullikin 1971, 160). During World War I, Governor Carothers vastly improved roads and automobile travel across the Eastern Shore increased, eventually displacing steamboat and railroad transportation (Mullikin 1971, 160; Rhodes 2007). Steamer service had mostly vanished by the 1930's, and earlier trans-Peninsular railroad lines connecting east to west were broken up. Thankfully, the effect of the Great Depression was dampened

on the Eastern Shore because of the availability of agricultural and seafood products (Mullikin 1971, 160). In 1918 Crisfield and Deal Island were said to be the biggest sources of soft shell crabs across the region (Lefferts 1918, 40). Lefferts discusses the relative ease and abundance of the waterman lifestyle, stating that many rural places were able to support large populations through fishing activities: "It is a healthy and independent existence with a nourishing, varied, and abundant diet—a life tending to develop sturdiness and self reliance." (41). This theme of self-reliance and independence is a culturally significant theme for local residents and will be discussed further in Chapter 8.

In the early twentieth century, the population was much higher than it is today, and the area even boasted several baseball teams (DIMCP Interviews 2014). A 1903 map shows the settlement pattern in and around Deal Island, MD, with homes clustered in inland areas (Appendix B). A little later, in 1940, a driving tour guidebook gives a population statistic for Dames Quarter, Chance, Deal Island and Wenona as 2,730 (Federal Writers Project 2016, 429-430). There were also several notable businesses and services available in the early twentieth century including a sail loft (for manufacture of boat sails), a cannery, a blacksmith, orchard, dairy, ice plant, doctor, movie houses, skating rink, merry-go-round, a hotel, and oyster-packing house near the steamboat wharf (Wheatley 2014). After World War II, significant out-migration occurred as people left for more lucrative employment opportunities in larger and industrializing towns and cities within the region (Mullikin 1971, 160).

This history of the Deal Island Peninsula area extends from the colonial era outward and highlights several themes. First, there is the theme of independence and

self-sufficiency, exemplified by the people in developing local and place-based economies that sustained them well until the mid 20th century. Second, Deal Island Peninsula area communities demonstrate a high capacity to cope with changing political, social, and economic conditions through the centuries. And third, there is an emphasis on the importance of a water-based way of life for the communities of the area. The past is meaningful to Deal Island Peninsula area residents and knowing key pieces of this history is important for understanding the development of the community's current-day composition.

Figure 2: Location of Deal Island Peninsula Communities and Marsh

Map by United States Geological Survey, 1972. Community names added for reference by K. Johnson.

Landscape

As mentioned before, the Deal Island Peninsula area is eighteen square miles of landscape and islands dominated by marsh, tidal waterways, and forests, interspersed with agricultural and residential land use along the Maryland shorelines of the Chesapeake Bay, and adjacent to the Tangier Sound (see Figure 2). Since nine of these square miles are water, settlement patterns cluster around historic towns and harbors, contemporary roads, and waterview sites. Many newer houses owned by weekenders or retirees occupy waterfront property with views of marshes or the Tangier Sound, while the historic homes and original communities are farther inland and located largely (though not entirely) on higher ridges across the Peninsula. One main road traverses marshes, creeks, and open water to connect several small communities situated on flat coastal plain with an average elevation of only three feet above mean sea level.

As one drives across the open marsh from one community to the next, one cannot fail to notice the prominence of saltwater marsh in the Deal Island Peninsula area landscape (areas in green in Figure 2). The marsh envelops each community, and along with the surrounding waterways, provides a natural barrier that separates each community from the other. The area's marsh is extensive and significant within Maryland, providing habitat for many important species such as grasses, woody plants, plankton, insects, fish, crabs, invertebrates, birds, and mammals (Scott 1991). The Deal Island Peninsula area marshes are particularly significant in providing fish and duck habitat, and are also used for hunting, fishing, and crabbing (U.S. Fish and Wildlife Service Chesapeake Bay Field Office 2016; Maryland Department of

Natural Resources 2016). Maryland's Department of Natural Resources (MD-DNR) manages nearly all of the marsh area on the Deal Island Peninsula.

Area residents appreciate that their rural living allows them to be closer to nature, and a key feature of this is the marsh. Power and Paolisso (2005) outline several cultural models for marshes in their needs assessment for the Monie Bay Estuarine Research Reserve (also managed by MD-DNR) on the Deal Island Peninsula. They report that locals see the salt marshes in several ways: "marsh as a land buffer, marsh as natural water filter, marsh as protection against development, marsh as recreation, and marsh as cultural heritage" (Power and Paolisso 2005, 38). The salt-water marsh acts as a buffer between water and upland settlements, farms, or woodlots. And, it is understood to be a "natural water filter" that can clean water of pollution and filter nutrients in addition to protecting and promoting biodiversity (Power and Paolisso 2005, 42-43). The marsh functions as a protection against development because it is under the jurisdiction of Maryland's Department of Natural Resources (MD-DNR) and the Monie Bay National Estuarine Research Reserve (MBR), and also because it is undevelopable. Recreational uses include fishing, exploring, hunting, swimming (Power and Paolisso 2005, 40-41). The marsh is cultural heritage for those who have grown up in the area. Many people will tell you how they spent their childhood playing in the marsh, wandering and looking for artifacts, and as they got older they used the marsh for hunting. Additional detail on the environment and impacts from climate change as well as environmental management of the Deal Island Peninsula area will be covered in Chapter 3.

The Communities Today

Throughout the Chesapeake Bay region livelihoods have changed with increased development and decline of water-based economies over the past century. Many small water-based communities not swallowed by urban or peri-urban centers have disappeared due to out-migration, rural isolation, or the encroachment of Chesapeake waters (Cronin 2005; Erwin et al. 2011; Leatherman et al. 1995). Declines in agriculture and fisheries make it necessary for household-level changes to ensure economic success (National Research Council 2004; Pelton and Goldsborough 2008; Paolisso 2002). Today, Deal Island Peninsula area community members support themselves on a mixture of newer and more traditional livelihood strategies, but many live in ways similar to their parents and grandparents—relying on the bounty of nature for their livelihoods. Driving through the area crab pots, crab sheds, work boats, and skipjacks (historic sail powered oyster boats) are common sights (also see Warner 1977).

The arrangement and structure of Deal Island Peninsula area communities has not changed much in the past one hundred years. With negative population growth and little to no investment in development (except for modest retiree and vacation homes), most buildings are historic. There are no chain gas stations, restaurants, or stores in the area, just two small convenience stores (one selling gas) available for food and amenities. This is due in part to the isolated nature of the area, but also because of lack of support for infrastructure development (e.g. sewerage) (Power and Paolisso 2005), and a general policy against development at the County level (DIMCP Interviews 2014). Most purchases are made in Princess Anne or Salisbury, MD, the nearest city. Deal Island does have an elementary school for the area's

younger children but they must go to Princess Anne for middle and high school. Several small churches with active congregations (mostly Methodist) maintain faith as a central and traditional component of community life.

Strong ties to place have developed through the generations. Long-time residents can trace their ancestry back several generations, some with ease to the colonial era (DIMCP Interviews 2014). One thing that you learn coming to the Deal Island Peninsula area is that everyone is somehow related to everyone else—it is not uncommon for people born in the area to know of more than one way in which their families are related. Community ethics of hard work and independence, combined with the rural character of the place have lead to insularity. Many residents are distrustful of outsiders and government intervention. Today the communities of Dames Quarter, Chance, Deal Island and Wenona retain their historic separateness and independence. These four communities are the primary focus of this dissertation work but other nearby communities will be mentioned periodically.

In addition to the descendants of long-time residents, communities in the Deal Island Peninsula also have a growing population of newcomers. These people are second-homeowners (weekend or vacation homes) and retirees and are called "come-heres." People who married into the community are called "brought-heres." Many come-heres have purchased waterfront properties and built modest homes along the shorelines with beautiful marsh and water views. Many of them chose to live in the Deal Island Peninsula area for its peaceful, quiet, and rural atmosphere. Just like the long-time locals, come-heres vary widely in their community participation. Some participate in local civic organizations and community social life while others do not.

As none of the communities have formal government structures, local social organizations undertake roles typically fulfilled by government in other locales. Several churches, the Lion's Club, Volunteer Fire Company, and more recently a heritage-focused organization help with communication and coordination of community effort. Self-sufficiency is a prized trait in the Deal Island Peninsula area, but people also support each other in times of need. These extended community networks often provide a safety net for identifying and supplying necessary assistance such as food, money, or transportation in order to take care of each other.

The Importance of Heritage

When locals talk about the area, there are several common threads that emerge including the beauty of the marshes, peace and quiet, helpful neighbors, and of course the annoyance of mosquitos in the summer. No one talks about life being easy or exciting, but you can sense the joy and satisfaction felt in putting in an honest day's work amongst the ebb and flow of their small piece of the world. Marshes and the Tangier Sound envelop the Deal Island Peninsula area (see Figure 3) and seem to set it apart from the rest of the region. Watermen, who go out daily to Tangier Sound and Chesapeake waters to catch blue crabs, oysters, and fish, remain an important cultural and economic backbone for the communities despite a steep decline in the number of working watermen through the years. Heritage is an ongoing and lived experience for residents, linking past to present on a daily basis (Paolisso 2002; Power and Paolisso 2007).

Figure 3: Deal Island and Chance, MD with View of Marsh and Tangier Sound

Credit: Jane Thomas, IAN UMCES Image and Video Library

The annual Deal Island Skipjack sailboat race has been held on Labor Day for over fifty years. The race convenes a fleet of traditional sail-powered dredge boats that were once a prominent watermen fishing vessel used throughout the region. The festival draws attendees from all over the region and celebrates the working watermen's history of the Chesapeake Bay. Even if people do not know much about the oyster industry and the history of the Skipjack they can still come and partake in this event celebrating Chesapeake heritage (see Figure 4). In addition, traditional markers of waterman's community can be found throughout the area. These include old wooden crab pots, pictures or models of sail powered oyster boats, and aesthetic pieces representing the blue crab feature prominently in art and decorations representing the Chesapeake Bay throughout the region. These are examples of what Chambers (2006) calls "public heritage": tangible representaitons of the past, such as pictures or figurines that are designed for others to access and consume.

But a second form of heritage, what Chambers calls "private heritage," is perhaps more important to local community members (Chambers 2006). This form of heritage is intangible, and only accessible through memories and stories told by community members to one another rather than the public. Private heritage includes discussions on the lineages of skipjack owners and captains through the years, or whose grandfather worked on which skipjack and with whom (DIMCP Interviews 2014). These features of heritage are important to local people. Experience working together on the water built bonds and linked families in ways that are very different from modern working conditions. One community member told me that at his grandfather's deathbed, a long-time crewmate and friend came to visit and climbed on the bed alongside the dying man to comfort him (DIMCP Interviews 2014). The significance of this act was not only that they had developed a strong friendship through years working together, but that the respect and trust of friendship meant more to them than the social norms of their day and compelled a breech of racial barriers. Stories such as this are intended to teach culturally important lessons and carry forward meanings for local community members that are often inaccessible to outsiders.

Figure 4: A Skipjack

Sail-powered oyster dredge boat at the 2014 Skipjack Race, Deal Island, MD. Credit: Katherine J. Johnson

A local heritage organization, Skipjack Heritage Inc. (SHI), is working to bridge these two forms of heritage (Skipjack Heritage Inc. 2014). This organization preserves the history of skipjacks in the Chesapeake region, but also functions as an important means for local heritage making. At the annual Skipjack Festival and Race, SHI members bring photos of local high school graduations and pictures of veterans that attendees enjoy perusing, remembering loved ones and connecting with each other. SHI has also established a local museum in Chance in 2015, and many of the items on display there are from local families. These items represent the past, marking difference in ways that outsiders may not perceive and understand it. For example, in the old building housing the museum there is a picture on the wall of an early 20th century shop counter with the shop's proprietors. Many of the area's older residents will recognize that the picture was taken where the viewer now stands. Others may only see a quaint image from the past. For those who share this private heritage, these encounters reinforce memories and feelings of family, friends, and experiences from the past will come flooding back. For others, the image poses an interesting question: "What must have it been like to live then?" Finding ways to blend the public and private heritages of the Deal Island Peninsula is important for the local community, but is also for the broader public and makes the past more accessible in the present for others who do not have this more private connection.

In addition to the celebrated waterman heritage the Deal Island Peninsula area has two other major heritage themes that should be acknowledged. First, the American Indian history of the Deal Island Peninsula area is not well known. After settlers colonized the area, an "Indian town" or reservation for Native Americans was

located near Monie Bay (Lyon 2004). Local sources indicate that the Monie Bay area (to the North and East of Dames Quarter) was home to American Indian communities and that there are six archaeological sites known in the Monie Bay area from a Maryland Historical Trust survey pre-dating 1990 (Power and Paolisso 2005, 33). There may be others around the Deal Island Peninsula area (DIMCP Interviews 2014). Local community members reported to Power and Paolisso that they would like to see this native heritage more well represented (Power and Paolisso 2005, 49). This heritage may be difficult to compile, and I am unaware of any descendants from the American Indian communities.

The other history and heritage that should be more fully explored is that of the African American community. At one time, the number of African Americans on Deal Island alone was greater than two hundred and thirty people (DIMCP Interviews 2014). In Dames Quarter, a Rosenwald School existed for the education of African American children in the early 1900's (Duyer 2014). Rosenwald schools were established by philanthropist Julian Rosenwald at the request of Booker T. Washington to better educate blacks in the rural South (National Trust for Historic Preservation 2016). In addition, there is a property that boasts an historic marker about "Henry's Beach" a former resort for African Americans, though one that was probably not used by locals (Swenson 2013). The remaining African American community members are aware of many more aspects of this heritage and would be an invaluable resource to help the history of this population for the Deal Island Peninsula area.

In summary, those living in the Deal Island Peninsula area have pride in their communities and the beautiful landscape. Many dynamics have changed since colonization of the area—much of it propelled by close association with the water and seafood extractive industries. As economics, demographics, and livelihoods continue to change for people in the Deal Island Peninsula area, a new kind of uncertainty is growing around climate change. How will people in the Deal Island area face this new threat? How are threats from climate change similar to or different from changes these communities have faced for generations? How do people in the area understand their vulnerability to climate change? What are the resiliencies they can draw upon to react and plan for climate change impacts? The future will undoubtedly be different as climate change impacts become more apparent and sea level rise takes a noticeable toll on this low-lying landscape. In the next chapter, contexts for climate change and environmental management in the Deal Island Peninsula area will be summarized. This information, alongside background knowledge from this chapter, provides a good introduction to the Deal Island Peninsula area.

Chapter 3: Climate Change and the Environment

Climate change is often seen to be an external stressor, an expected physical or environmental threat that we must do something about. For example, by planning to protect shorelines against sea level rise. The President's Climate Action Plan emphasizes these future effects with a quote from President Obama in 2013, saying:

> Science, accumulated and reviewed over decades, tells us that our planet is changing in ways that will have profound impacts on all of humankind…those who are already feeling the effects of climate change don't have time to deny it—they're busy dealing with it. (White House 2016)

However, the President's quote also highlights that there are already seen and felt impacts from climate change. While many will experience change in the future some are already feeling the affects of climate change's impact. Planning for and adapting to these changes depends in large degree upon what we recognize and understand as threats and impacts. This chapter focuses both on the consequences of climate change as well as important considerations of environmental governance from the global to local scale. In the first section, I begin by highlighting the current scientific understanding of global climate change effects and then outline more detailed information regarding climate change impacts for the Chesapeake Bay region. The second section summarizes important contexts of environmental governance and management. In the chapter's final section, I discuss local views of climate change and environmental management among Deal Island Peninsula area residents. Together, this chapter provides a summary of anticipated impacts from climate change, contexts for environmental change and relevant features of environmental management, and insight into local environmental knowledge regarding climate

change. These views and understandings are important for general knowledge, but also for later analyses of vulnerabilities and resiliencies to climate change presented in Chapters 7 through 10.

Global Change

The most recent IPCC report (2014) details evidence of past surface temperature warming, ocean warming, ocean acidification, melting of ice sheets and glaciers, decline in Arctic sea ice coverage, and global mean sea level increase; and clearly positions increasing greenhouse gas emissions since the Industrial Revolution as the cause of current warming patterns and increasing vulnerability (IPCC 2014, 2-4). In the future, climate change is expected to continue at an accelerated rate. Scenarios for global surface temperature warming vary greatly and are dependent upon continued emissions levels. Between 2081-2100, temperature increases are expected to range from 0.3°C to 4.8°C relative to 1986-2005 levels (IPCC 2014, 10). The extent of sea level rise will also vary globally, but increases are expected for 95% of coastal areas. For 2081-2100 when compared to 1986-2005, projected sea level rise ranges from 0.26 m to 0.82 m (IPCC 2014, 13). Warming will continue past 2100 in all except for the lowest emissions projections, and sea level rise is certain to continue past 2100 whether or not we limit or halt emissions (IPCC 2014, 16). Although sea level rise and global warming are not the only effects that may impact the Deal Island Peninsula area region, they are the main drivers for more localized effects.

Climate change's large-scale reach means that impacts will have many direct, indirect, and systemic effects. Pelling theorizes it this way:

> The impacts of climate change will be felt directly (weather related and sea-level rise events), indirectly (through the knock-on consequences of

> reduced access to basic needs as critical infrastructure is damaged or employment lost) and as systems perturbations (the local implications of impacts on global commodity prices or international migration). (Pelling 2011, 25)

The physical changes, however, will also be compounded by multiple interactions from the region's human residents and their associated socio-economic and political realities. In 2010, Paolisso argued that:

> No systematic research has been undertaken to investigate how climate change will impact cultural and socio-economic processes, and vice versa across the Bay region. (Najjar et al. 2010, 15, and personal communication with M. Paolisso February 2016)

Since that time, some work has been done in Dorchester County with African American communities on vulnerability to climate change (Paolisso et al. 2012; Miller Hesed and Paolisso 2015). But, there is still a need for additional research on climate change that contributes both theoretically and practically to communities and local systems. Najjar and colleagues (2010) also argue that local knowledge can help to inform science, and that scientists and policy makers may not be as effective as they would like to be in climate change adaptation efforts if "cultural perceptions of climate change" do not match "models of climate change and impacts deployed by scientists and policymakers" (Najjar et al. 2010, 15). Investigating these matches and mismatches between local knowledge, scientific knowledge, and perceptions of threat from climate change across a social-ecological system is an important project. Shaffer and Naine's (2011) work in Mozambique investigating mental models of climate change helps to clarify climate change impacts that are unclear through regional climate projections (Shaffer and Naiene 2011). Similarly, research is needed in the Chesapeake region to better understand how humans will impact and be impacted by the environmental effects of climate change. Knowing some larger context for the

Chesapeake region's readiness to deal with climate change is important to understand social and environmental implications for the Deal Island Peninsula area.

Climate Change in the Chesapeake Region

The global forces outlined above will interact with other factors to result in strong effects for the Chesapeake region and on the Deal Island Peninsula area. With an average elevation of only three feet (0.91 m) the area's changing and dynamic environment is under threat from climate change—particularly sea level rise. A 2013 report by the Maryland Climate Change Commission predicts a 2.1-foot (0.64 m) rise in sea level for the Chesapeake region by 2050 and warns of further threat from flooding and increased storm severity (Boesch et al. 2013, 16). Through Deal Island Marsh and Community Project (DIMCP), it became apparent that stakeholders needed a more localized projection for sea level rise, and one within a closer timeframe. Dr. Michael Scott at Salisbury University provided a projection that 2030 water levels would be about ten inches higher than current levels, based on current models (DIMCP Workshop January 2016). This projection is comprehensible to DIMCP stakeholders, but there are many other regional climate change impacts for which it is not so easy to quantify a localized effect.

In a climate-changed future, impacts to the Chesapeake region will be notable. Carbon dioxide levels will increase 50-160%, sea level will increase by 0.7-1.6 m, and water temperatures will increase between 2°C to 6°C by the end of the twenty-first century (Najjar et al. 2010). Due to ecosystem dynamics and confounding effects, the following results related to the Chesapeake Bay's health area also expected:

> (1) an increase in coastal flooding and submergence of estuarine wetlands; (2) an increase in salinity variability on many time scales; (3) an increase in harmful algae; (4) an increase in hypoxia; (5) a reduction of eelgrass, the dominant submerged aquatic vegetation in the Bay; and (6) altered interactions among trophic levels, with subtropical fish and shellfish species ultimately being favored in the Bay. (Najjar et al. 2010, 1)

These negative impacts are limited not to the Bay's waters, but will have clearer and wider ranging cascading effects for the Deal Island Peninsula area. To summarize, the projected changes above include: increases in sea level, flooding, storm severity, carbon dioxide, water temperature, salinity, harmful algae, warm water fish and shellfish; as well as decrease in wetlands, oxygen and aquatic vegetation available in Chesapeake Bay waters, and other existing aquatic species. While all of these will affect the Deal Island Peninsula in some way, the primary impacts apparent through this literature to local peoples include sea level rise, flooding, increased storm severity, and decrease in wetlands. The other factors relating to the species composition and dynamics of the Chesapeake Bay's waters will more likely affect Deal Island Peninsula area watermen, rather than the general population. This means that the Deal Island Peninsula area is facing the disappearance of land and wetlands, increasing and problematic waters along shorelines, ditches, tidal streams, on wetlands, and in low lying areas, and increasingly severe storms causing flooding and damage. How will people cope with these changes? How will they understand trajectories of ongoing change in relation to additional pressures from climate change? What mechanisms of environmental governance are in place to allow people in the Deal Island Peninsula area to begin thinking about these questions? The threats outlined above will impact the area in different ways, and it is important to think about what kinds of resources are available

in terms of environmental management and governance to plan for these impacts. This issue of management and governance is important, but will only be dealt with here briefly to provide some basic context for interpreting later information on climate change vulnerabilities and resiliencies.

Global and Regional Contexts of Environmental Management

As a large-scale problem plans for adaptation to climate change come from multiple arenas. Only a few thoughts will be presented here in order to make clear some of the structural difficulties in planning for adaptation. In relation to climate change on a global scale, two types of information are highly regarded: evidence of existing impacts and information related to predictions for the future. IPCC data is used as a standard for global statistics because it is a consensus developed by scientists from all over the world (IPCC 2014). From the perspective of the local person disassociated from global discourse or for whom local and experiential realities make global knowledge questionable, this broad scale view may not resonate in the way it would for those who are more comfortable with a broader discourse. Hulme expresses it this way:

> The consensus science of the IPCC might look persuasive from the centralised sites of production. The views from the peripheries of space, of power and of culture – the very places where knowledge is consumed – look very different. We need to understand this story and tell it widely. (Hulme 2008, 9)

Hulme is pointing out that what we take to be a global standard for climate change information and predictions (in this case the IPCC data) may not be readily accepted as such by those who are more distant from it—an important issue when working with local communities. What do they see as threats from climate change? How does

experiential knowledge inform them about the substance of climate change? How do they accommodate global discourse from the media and other sources? How do they interpret climate adaptation discourse as perhaps informing and also negating the vulnerabilities and resiliencies they see for themselves in their own particular situations? These questions are similar to those posed by Barnes et al. (2013) in their review of anthropology's contribution to the study of climate change. Information such as this should be kept in mind with any analysis of resilience and vulnerability to climate change, and Chapters 7 and 8 provide insight into these questions for people in the Deal Island Peninsula area.

Global efforts to mitigate or adapt to climate change have been thus far seen as largely ineffective (Rowley 2015). Only with the latest Paris agreement (December 2015) do most feel we are finally making cooperative progress in setting wide-reaching targets and agreements to reduce greenhouse gas emissions and begin climate adaptation conversations (Dews and Dhar 2015). This global scale work is proceeding slowly but is being supported on a national level here in the United States with the President's Climate Action Plan that focuses both on reducing greenhouse gas impacts and in developing and supporting climate adaptation strategies (White House 2016). In a comprehensive review of climate change adaptation actions across the U.S. Bierbaum and colleagues (2013) outline the efforts on the Federal, State, non-governmental, and private sectors. For example, Maryland is noted for its efforts in creating living shorelines (10). This outline provides an initial indication of how pervasive climate change adaptation processes are becoming across the U.S., and gives some indication of the diversity of efforts. The authors discuss the need for

collaborative and iterative planning and management in addition to covering many barriers to climate change adaptation planning (Bierbaum et al. 2013). Across the U.S., climate change is undeniably becoming a formative management and planning endeavor with a variety of top-down or bottom-up approaches and applications. This diversity also exists within the Chesapeake Bay region.

In the Chesapeake region, states have been the primary enforcers of environmental governance until just recently with newer regional-scale initiatives. The Chesapeake Bay is the United States' largest estuary, and a site of contentious resource regulation and increasingly strict environmental management for conservation and pollution reduction (Chesapeake Bay Program 2012; Ernst 2010). A number of organizations at the state and regional level have partnered to work toward restoration and conservation activities and to track and communicate progress under the umbrella partnership organization of the Environmental Protection Agency's (EPA) Chesapeake Bay Program (Chesapeake Bay Program 2012a). They utilize environmental indicators as a management tool and employ "state of the art science" to achieve "environmental results" (Chesapeake Bay Program 2012b). The management of the Chesapeake Bay via the efforts of the Chesapeake Bay Program is an excellent example for complex social-ecological systems management elsewhere (Power and Paolisso 2007). These Partnership's efforts are supported both by non-profit organizations and governmental agencies, and within the past few years the Federal government has facilitated the adoption of the strongest regulations to date. This includes the Chesapeake Bay Total Maximum Daily Load (TMDL), an EPA regulatory "pollution diet" to reduce problematic nutrient and sediment loadings to

the Bay under the authority of the Clean Water Act (U.S. EPA 2015). The TMDL is a common regulatory mechanism for addressing excess pollution, but has not previously been employed at such a large scale (EPA 2010, 3). The purpose of the TMDL is to restore Chesapeake Bay waters to fishable and swimmable condition by 2025 (U.S. EPA 2015). The Federal government has now become involved with regulation of the Chesapeake Bay through mandates like the TMDL, and has changed how environmental management functions within the region. The reductions in nutrients and other standards are passed down to the state and subsequent County levels for more local jurisdictions to implement. Therefore, although this federal oversight spans the region new forms of localized government are not created. Although these regulations do not deal specifically with climate change, it is important to note that strategies for environmental management are trending toward more centralized governance, but with actions fulfilled by existing entities rather than new forms of oversight.

In Maryland, there have been multiple efforts to both educate on climate adaptation and spur climate adaptive activities. Many of these are reflected in Maryland's climate vulnerability reduction two-phase strategy, summarized by Thomas and Johnson (2008) and Boicourt and Johnson (2010). On the state level there is support for actions to protect multiple sectors across the State of Maryland. These include health, agriculture, forests, aquatic ecosystems and resources as well as population and infrastructure (Boicourt and Johnson 2010). Particular threats are reduced air quality, heat stress, vectors of human, plant and animal disease, decreased potable water, shifts in species distributions, and sea level rise and inundation in low-

lying areas (Boicourt and Johnson 2010). Suggested strategies to act on these threats include: tracking, educating, and designing prevention programs for human disease; improvements to monitoring, developing projections and education programs for farmers; improving, monitoring and information for resource managers; and investing in initiatives to protect land, forests, reservoirs, critical ecosystems, wetlands, and riparian and coastal habitat (Boicourt and Johnson 2010). Priority recommendations include: revision of restoration goals in light of climate change impacts, integrate mitigation and adaptation strategies; monitoring and revision of natural resource policies and regulations to accommodate climate change effects; and increasing collaboration across Federal, State, local, and regional "climate adaptation partners" (10). These are the kinds of efforts being made on the state level to adapt to climate change. It is important to note that strategies and recommendations focus on monitoring, education, protection of land and coastal areas, policy flexibility, and in cross-scale collaboration. Multiple processes underpin efforts in climate change adaptation, and these range across sectors that may be more or less well connected. With this additional information related to managing for climate change on the state and regional level, I will turn now to a discussion of environmental management in a more local context for the Deal Island Peninsula area.

Local Contexts for Environmental Management

The Deal Island Peninsula area has a particularly bifurcated structure of environmental management. Nearly all of the non-residential land is under the jurisdiction of Maryland's Department of Natural Resources (MD-DNR). MD-DNR manages the land to conserve salt marsh, promote fish spawning habitat, encourage

wildfowl inhabitation and hunting, and also to reduce prolific mosquito populations (Lesser 1982). The Deal Island Wildlife Management Area (WMA) is delineated in Figure 5. All areas outlined in black are MD-DNR managed areas. The WMA was established in the early twentieth century and is well known for its waterfowl hunting. In addition to extensive marshes and copious ditches, the area includes a man-made impoundment to attract birds. Deal Island Peninsula area marshes were ditched throughout the twentieth century but particularly in the 1930's as a Civilian Conservation Corp project. The purpose of the ditching was to drain marshes and promote fish spawning habitat as well as to reduce mosquito populations (DIMCP Workshop April 2013). The area also hosts hiking trails and is a favorite spot for bird watching and recreational crab catching (Maryland Department of Natural Resources 2016).

Figure 5: Deal Island Wildlife Management Area

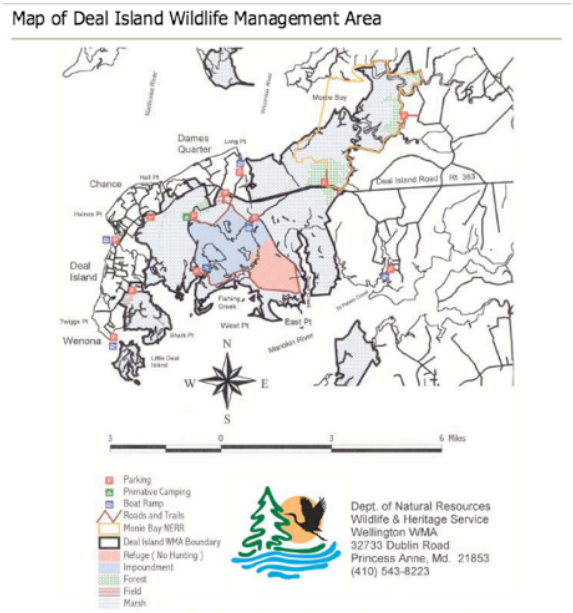


Image from DNR website:
http://dnr2.maryland.gov/wildlife/Pages/publiclands/eastern/dealisland.aspx

Included within MD-DNR's wildlife management area is the Monie Bay National Estuarine Research Reserve Component (MBR). MD-DNR manages the Monie Bay area for NOAA's National Estuarine Research Reserve System (NERRS) (NOAA Office for Coastal Management 2016). The MBR was established in 1985, and is one of three NERRS sites in Maryland which constitute part of the Chesapeake Bay National Estuarine Research Reserve (MD-DNR Watershed Services Coastal Zone Management 2012). The reserves are designed to provide stable areas in which to research estuarine environments, develop best management practices, and enable public access to and education concerning estuarine environments (MD-DNR Watershed Services Coastal Zone Management 2012, 11-12). The Monie Bay component did not have regular public access until recently when it established a water trail system in September 2014. The reserve also hosts researchers from all over Maryland who are interested in learning more about estuarine environments and how marshes accrete over time.

The MBR and WMA have different but related goals. Despite their varied purposes and the fact that they are managed by two separate divisions within MD-DNR, most local people do not view these two as distinct and instead conflate them as wildlife lands managed by MD-DNR (Power and Paolisso 2005). Historically, MD-DNR has managed the marshes with little to no input from community members and their management decisions do not always have local support (as will be discussed later in Chapter 7). As far as I know, there are no clear indications from MD-DNR concerning a climate change adaptation strategy for the localized area.

However, we can surmise that their goals will be in accordance with the State's climate adaptation strategy (Thomas and Johnson 2008; Boicourt and Johnson 2010).

The context for managing the environment (and therefore the default for planning, adaptation, and coping mechanisms) of the Deal Island Peninsula area is very important. As local communities have no form of local civic government, environmental management is disassociated from local residents. Individual landowners manage all lands other than the WMA and MBR. They are responsible only for meeting legal obligations that the state sets forth in terms land management. Local landowners are subject to rules and regulations for development and housing, shoreline protection and maintenance, ditching, etc. that are set at the state and county levels. All other climate adaptation planning must come from alternate sources. For the Deal Island Peninsula area, there is no form of government or environmental organization that stands ready to help with broad-based climate change adaptation.

Local Views of Climate Change

Local community members agree that the natural environment has changed and is expected to continue to change into the near future (DIMCP Workshop April 2013). Although there are diverse perspectives within the local community, one perspective in particular is important to highlight. Many locals have a complex and dynamic view of the natural environment as being shaped by not-entirely-understandable causes (see Paolisso 2002 for well-articulated views on the "unknowable-ness" of nature by Chesapeake watermen). A significant portion of this is due to faith in God and the idea that what happens in this world is in His hands. The environment is seen as something that is not under human control, and many

local residents acknowledge their lack of ability to influence the course of nature. This translates to the global scale as well and therefore some local residents to not believe in anthropogenically caused climate change. They feel that environmental change occurs as it always has, but that the discourse of climate change is unnecessarily dramatized and blown out of proportion by the media (DIMCP Interviews 2014). There is an underlying distrust of science and outside opinions, particularly in light of residents' history with fisheries regulations and MD-DNR land management (DIMCP Interviews 2014, Paolisso 2002). They see those regulations as unfairly burdening them with regulatory policy that limits their livelihoods. Local community members expect to experience environmental and climate change in ways similar to threats and disturbances they have experienced their entire lives—through tidal and storm flooding, erosion, marsh degradation, and other incremental changes. Yet this does not mean changes in the environment are not severe or serious; indeed climate change and environmental change are of great concern. This brief summary of local views concerning climate change will be expanded upon further through descriptions of vulnerability and resilience given in Chapters 7 and 8.

Climate change will undoubtedly have important impacts for the Chesapeake Bay region. IPCC predictions position sea level rise and global warming as particularly pertinent threats to low-lying coastal areas (IPCC 2014). The Chesapeake Bay region will be altered not only by warming and sea level rise, but a host of other forces that will change the composition and dynamics of air, water, weather, diseases, and plant and animal species. In addition, there will be consequences to human health, agriculture, forest management as well as compounding issues. The Deal

Island Peninsula area does not have a form of governance or management to take on the issue of climate change, and with management divided between local homeowners and MD-DNR, additional work is needed to bridge this divide. One means for bridging this gap and beginning to think about resilience planning for climate change comes in the form of the Deal Island Marsh and Community Project (DIMCP). The project brings together multiple parties to begin to learn about and address issues of climate change, particularly vulnerability and resilience. In the next chapter, I explore my approach to engaged environmental anthropology as well as the structure and function of the DIMCP to better describe the ways in which researchers, local community members and others are addressing the issue of climate change in this context.

Chapter 4: Mechanisms for Community Engagement

A core focus of this dissertation is on understandings of experienced or anticipated states of future climate change for the Deal Island Peninsula area. As such it is important to clearly delineate the ways in which I approach and am involved with the local community. My ability to work and participate in the area is through the Deal Island Marsh and Community Project (DIMCP) to build resilience to climate change. This project will be described in more detail below but relies on a collaborative learning approach and on collaborative science to engage local community members, environmental managers, and other with interest in the region. Before exploring the DIMCP, collaborative learning, and collaborative science in more detail, however, I will outline my perspective on what an engaged environmental anthropology of climate change might look like as a basis for understanding my approach. Engaged environmental anthropology, the DIMCP, collaborative learning, and collaborative science are introduced and discussed here to provide insight and information related to mechanisms of engagement with people in the Deal Island Peninsula area. This is a key addition to the descriptive introductions on the area's history, communities, environment, and climate change. Through this chapter, the reader will gain a better understanding of my relationship with the community before focusing on theory and method.

Engaged Environmental Anthropology

In recent decades, anthropology has widened its traditional approach in order to focus on work that has "contextualized […] communities within the context of macrolevel forces" (Baer 2012, 217). Baer uses the term engaged anthropology to

incorporate both public and practicing anthropology, but also to emphasize focus on "crucial issues of the day" (Baer 2012, 217). One of the crucial issues of today, of course, is climate change. This allows anthropology to take on pressing and important contemporary issues. In the case of this dissertation, I see an engaged environmental anthropology as helping to articulate research and action with and between climate change adaptation and environmental management on both a local, regional, and global scale.

Engaged environmental anthropology seeks to participate in ongoing processes supported by communities or constituencies. Rather than just studying and recording information, engaged anthropology positions the researcher as one individual among many with interest in an issue or problem. There is both an expansion of scope and dire need for attention to detail in this type of work. Michael Agar (1996) describes it this way:

> …ethnography in the modern, or postmodern, era has to change in several important ways. It has to deal with ethnographic detail as part and parcel of political economic process. It has to move closer to the ground and represent lived worlds and collaborative relationships in construction of the product, including a clear representation of the ethnographic role—interests, social identity, biography, and the like. It has to deal with issues of power as well as context and meaning. It has to handle the contradictory and complicated lives that all of us now lead. (50)

The role of the ethnographer, and his or her engagement with a local community (or communities) is crucial to the production of ethnography. As a social science, the practice of anthropology results in experience, data, and the representations of those interactions through writing. Ethnography therefore becomes also a tool of engaged environmental anthropology. It is important to be explicit about the process of and role for analysis:

> A culture is expressed (or constituted) only by the actions and words of its members and must be interpreted by, not given to, a fieldworker. To portray culture requires the fieldworker to hear, to see, and […] to write of what was presumably witnessed and understood during a stay in the field. Culture is not itself visible, but is made visible only through its representation. (Van Maanen 1988, 3)

Ethnography signifies an explicit choice by the ethnographer to represent a culture and issue in particular ways. Care has been taken with this dissertation to draw in relevant information, theory, and method to better contextualize the data presented. More detail on the conduct of multi-sited ethnography is given in Chapter 6.

Engaged anthropology must be comfortable with shifting knowledge and priorities. And, what may be most important are what needs are identified via engagement with communities or dictated by the constraints of the system. In this case, climate change poses a threat to which local insights help inform understanding of the problem and potential solutions. Engaged anthropology can play a bridging role as Puntenney (2009) argues:

> Bringing a cross-cultural perspective that draws from a number of disciplines and areas of professional expertise in gathering concrete data, anthropologists can bridge and identify an expanded repertoire of options in the decision-making process. Anthropologists can be particularly useful in redefining and expanding potential roles for stakeholders and bringing people together in mutually beneficial ways from the local initiative to the development of national and/or regional environmental plan of action. ((314)

The Deal Island Marsh and Community Project is the mechanism for community collaboration and cross-scale interdisciplinary interaction. It will be discussed in more detail in the following section. The DIMCP was designed to proceed not only through academic research projects, but also through cross-constituency cooperation to define and redefine the scope of work over the course of long-term engagement. Outside demands can cause unforeseen consequences for the various parties. As

anthropologists, we are positioned within broader and shifting contexts of research that explores questions such as: who is involved in the work, what funding or political forces set the agenda, what academic or practitioner models for engagement are used, and which theoretical constructs orient the work and dictate how it is evaluated and reevaluated?

West (2005) cautions that while embedded in these processes we must be incredibly careful about what our work as anthropologists actually accomplishes. In her case, she worries that work to understand and translate Gimi local knowledge will "generify" that knowledge and reduce its meaningfulness, richness, and complexity ((639). She says:

> As environmental anthropologists, we have to think carefully about how we translate socioecological lives, and we need to locate the politics of translation, value, and spatial production at the heart of an engaged environmental anthropology. (640)

Our work as engaged environmental anthropologists is not value neutral. In my case, I am studying the social-ecological system of the Deal Island Peninsula with a particular eye toward understanding system representatives' knowledge of vulnerability and resilience to climate change. With this knowledge of vulnerability and resilience, and some additional contextual information, the reader will gain a fuller understanding of the problems at hand. With a richer understanding, more knowledge is used to inform potential interactions and actions related to ameliorating climate change. More options are created for strategizing for the future. This is important work with valuable potential contributions. By exploring ethnographically-based understandings of vulnerability and resilience for the Deal Island Peninsula area we will better understand processes of and possibilities for climate change

coping and adaptation. Therefore, engaged anthropology can play a clear role in planning and governing climate change efforts in the Chesapeake region (for a delineation of climate change adaptation vs. coping please see Oliver-Smith 2013).

The Deal Island Marsh and Community Project

The Deal Island Marsh and Community Project (DIMCP) is an outgrowth of work funded by the NOAA NERRS Science Collaborative Program from Fall 2012 to Summer 2015. The original grant, titled "Integrating Socio-Ecological Research and Collaborative Learning to Promote Marsh and Community Resilience," positions academic research alongside collaborative learning to promote resilience in marsh and communities into the future[1]. The grant's Principal Investigator, Dr. Brian Needelman is a specialist in tidal wetland soils from the University of Maryland's (UMD) Department of Environmental Science and Technology. Dr. Michael Paolisso, an environmental anthropologist from UMD's Department of Anthropology, served as the project's collaborative lead. The project brought together a vast cohort of researchers from UMD alongside representatives from MD-DNR and managers for the MBR site. Project objectives were to: carry out traditional academic projects in ecology, biology, economics, and anthropology; share this information with the local community and relevant organizations and agencies; develop and test a broadly transferable process of engaging stakeholders to optimize and implement strategies that restore and conserve marshes and local communities; and better understand the provision of socio-ecological services by marsh systems and decision-making processes within the stakeholder community using integrated anthropological,

[1] Funding for engaging the community in the DIMCP came from the NERRS Science Collaborative and was based at the University of New Hampshire for the duration of

economic, and ecological applied science. The project's final report from June 2015 provides additional detail on these findings (Needelman et al. 2015).

Dr. Paolisso has worked as an environmental anthropologist in the Deal Island Peninsula area for over fifteen years. While this project grew out of interaction between academic researchers and MD-DNR personnel, Dr. Paolisso's involvement was critical in engaging local community members and in suggesting the collaborative learning methodology (described further below) that was a key component to the project. In their 2005 Needs Assessment Report for the Monie Bay NERR component, Power and Paolisso recommended collaborative learning as a methodology that can bring local community members into relationship with the MD-DNR managers of the NERR reserve (Power and Paolisso 2005). Scientific collaboration, an objective of NOAA's National Estuarine Research Reserve System, was accomplished by using collaborative learning, as will be described in more detail below. The grant funded natural science research focused on issues related to marsh health, hydrology, and species distribution. Social science research focused on valuation of social-ecological services, ethnographic study of community and region, and on the facilitation of collaborative methodologies (Needelman et al. 2015). But the DIMCP became known locally in the Deal Island Peninsula area more for its activities than for its research.

The DIMCP's public face was a series of daylong workshops to which a diverse group of stakeholders were invited. These workshops served to communicate information to, and share information among, a fairly consistent group of stakeholders. Academic researchers, local community members, environmental

managers, and other non-profit and governmental representatives who had interest in the Deal Island area were invited. Other activities included "community conversations" which were open to the public and held to give information on flooding, marsh restoration, living shorelines, faith, heritage, the environment, and collaborative research projects in which stakeholders elected to participate on the topics of flooding and erosion, marsh restoration, and heritage. These activities were designed to share knowledge and build new relationships among participants. By linking stakeholders from the local community to others at the county, state, and federal levels, the project aimed to foster new participant networks that could be used to develop and support marsh and community resilience activities.

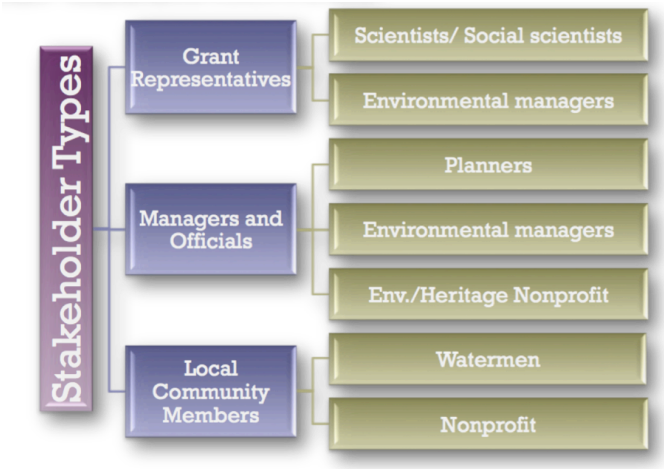
DIMCP Stakeholder Network Composition

The Deal Island Marsh and Community Project spurred the development of a cross-system stakeholder network that is representative of the Deal Island Peninsula area social-ecological system. This network functions as an important mechanism for engagement and data gathering and will be described further here. Social relations on the Deal Island Peninsula coalesce around familial relations, church and civic organization membership, and ties built through work relationships, for example, one's trusted boat mechanic or a regular crewmember during the crabbing season. Since there is no local government and few ties with county and local representatives and managers, the community is quite independent. Local community members are often not informed of management decisions for the substantial marshlands in their vicinity. Because local community members are disassociated from structures of governance and environmental management, a need was identified for the DIMCP to

bridge the local and nonlocal divide. Therefore, project leaders invited individuals with experience in governance and environmental management to participate in a collaborative learning process alongside local community members.

More than fifty project stakeholders were invited to participate in the DIMCP, based on research focus, areas of expertise in governmental or non-governmental management, and leadership standing within the local communities. The primary categories for describing stakeholders include: grant representatives (academics, scientists, environmental managers and those responsible for grant administration), officials and managers (local county government representatives, non-profit representatives from regional and state organizations), and local community members (including watermen, community leaders, and civic organization representatives). This unique network includes 40% representation from the local community; 20% representation from university researchers; 20% state environmental managers, outreach specialists and coastal planners; and 20% from environmental and heritage non-profit organizations. The network is experientially, professionally, and geographically diverse and reflects the Deal Island Peninsula area social-ecological system. Figure 6 represents the DIMCP network by stakeholder type.

Figure 6: DIMCP Stakeholder Types



Created for DIMCP stakeholder activities by K. Johnson

For the purposes of this dissertation it should be noted that I have paid attention to and prioritized the views of local community members and stakeholders. In subsequent chapters, the reader will find that I discuss primarily local vs. nonlocal views rather than the three stakeholder types presented above. This is for two primary reasons. First is that I wanted to keep our understandings of vulnerability and resilience as close as possible to the local community and place of the Deal Island Peninsula area. This allows the reader to engage first at a basic level with vulnerability and resilience information before extending outward to incorporate nonlocal and more regional, state, and scientific perspectives. The second is that the work of this project is to support the local community and the local area's resilience to climate change. In order to do this, we must recognize what is relevant in a specific local context in addition to larger frameworks of information from outside sources. In writing up this material I have chosen to prioritize the local and utilize nonlocal

perspectives to enhance or add information where necessary. It should be noted that although several sources of difference or disagreement are mentioned, the overall purpose of this dissertation is to create a holistic perspective of vulnerability and resilience across the social-ecological system. But I have prioritized the local view in order to do so.

The DIMCP began as a singular grant-funded activity, but has grown into an ongoing collaborative effort among social and natural scientists, environmental managers, non-profit and governmental representatives, and local community members. Additional funding has been received from the UMD's Colleges of Behavioral and Social Sciences and Agriculture and Natural Resources, MD-DNR Chesapeake & Coastal Service, the U.S. Geological Survey Water Resources Research Program, and the Maryland Sea Grant College. As the DIMCP continues, the overall goal to improve resilience and reduce vulnerability to climate change impacts will continue through efforts to sustain and strengthen collaboration as part of a geospatial coastal resiliency assessment that will be corroborated and evaluated by the local community. This resilience assessment will also include a cultural consensus analysis related to climate change adaptation strategies, a social network analysis to further understand stakeholder network development, and community visioning and adaptation planning activities. These activities are linked and referred to as the "Integrated Coastal Resiliency Assessment." Additional activities will be planned as future support becomes available. More information may be found on the project's website: http://www.dealislandmarshandcommunityproject.org.

Collaborative Learning

Collaborative learning (CL) is an approach to cooperative natural resource management developed by Daniels and Walker in the early 2000's. It is designed to produce a mechanism for varied parties to work together on environmental management problems. In this case, CL has been applied within the DIMCP to help make progress toward building resilience to climate change for the Deal Island Peninsula area. Daniels and Walker stress that CL is not a methodology or framework—but an orientation for approaching situations of conflict in environmental management (Daniels and Walker 2001, xviii). Utilizing insights from complex systems theory and the fields of experiential learning and conflict-resolution, the CL approach can minimize cultural and economic conflict concerning environmental issues (Daniels and Walker 2001; Feurt 2008). The goal is to build a process through which people can work together in an adaptive manner that relies upon appropriate science and technology, as well as strategies that are implementable and have low transaction costs (Daniels and Walker 2001, 2-3). Collaborative learning is not for every situation of conflict in environmental management but ones in which there is some room for contestation and negotiation.

Collaborative learning seeks to achieve an important objective: to span the divide between "technical competence" and an "open process" for decision-making (Daniels and Walker 2001, 4). The approach helps to overcome a paradox, as described by Daniels and Walker:

> People feel they should have a voice in public decisions that affect their lives, but how can that voice be meaningful if the terms, concepts, and technical trade-offs are all new to them? (4)

Collaborative learning works as a series of events and activities that build knowledge at the interface between local community members and environmental managers. Implementing a technically sound but democratically oriented process can be difficult, and CL is designed to forge the necessary public consciousness by creating "informed judgments" that can lead to effective decision-making and policy (7).

Daniels and Walker (2001) argue collaborative processes have potential to achieve balance between technical competence and inclusive deliberation, noting: "Collaboration involves interdependent parties identifying issues of mutual interest, pooling their energy and resources, addressing their differences, charting a course for the future, and allocating implementation responsibility among the group" (10). Collaborative learning helps stakeholders to develop a "set of improvements" in "a situation of mutual concern" (21). There are likely multiple perspectives from which local community members, resource users, environmental managers, state and federal agencies, and other interested parties are positioned. Therefore CL is designed to "promote creative thought, constructive debate, and the effective implementation of proposals that the stakeholders generate" (15). While they may have different views and values, the constituents must work interdependently to devise potential solutions.

Equity and involvement among stakeholders is central to the process. CL cannot be used to pursue facilitator's goals, favor one group over another, or "market" a pre-made decision (Daniels and Walker 2001, 22-23). All parties should be empowered through the process by "creating a constructive environment that allows the knowledge and values held by individuals to be combined into a larger understanding of the situation" (21). While stakeholders gain a "meaningful voice,"

decision-makers gain "relevant, timely, and useful input" (24). As an open process that is tailored to the specific situation in which it is implemented, the CL approach lends itself well to complex issues such as climate change that are highly contested and uncertain.

Within the DIMCP, the CL approach is being used to bridge gaps across the social-ecological system of the Deal Island Peninsula area with regard to resilience to climate change. The organization of collaborative engagement across our stakeholder groups is supervised by Dr. Michael Paolisso and informed by the work of collaboration professional Dr. Christine Feurt who uses and expands upon Daniels' and Walker's approach in working with a NERR reserve in Maine (Feurt 2012). The DIMCP hosted a series of events to promote sharing of information across the social-ecological system's social network mentioned above, including workshops, topical collaborative research projects, community conversation meetings, and field trips.

Six daylong workshops were held for DIMCP stakeholders between April 2013 and April 2015 with attendance ranging from 20 to 38 individuals. Workshops were designed to ensure that interactive data collection and collaboration activities occurred alongside general project updates and presentations of research findings. Data were collected related to beliefs and values of climate change, understanding of the local environment and the human position within it, as well as vulnerabilities and resiliencies faced by the Deal Island Peninsula socio-ecological system. Scientific presentations covered a variety of topics such as geologic and shoreline change of the area through time; socio-ecological services valuation; mosquito population dynamics; and experimental testing and data collection concerning marsh hydrology

and health. In addition, informal conversation was encouraged with breaks, a long lunch, and frequent small-group activities. The workshops proved to be the core activity of the stakeholder network and allowed diverse stakeholders to come together to share knowledge and information in meaningful ways.

Community Conversation meetings functioned as an important public-outreach component of the DIMCP. Four evening community conversations were held in Fall 2014 and early 2015 with attendance ranging from 24 to 28 individuals. Attendees were either DIMCP stakeholders or local community residents. Community Conversation presentations were given by academic researchers, environmental managers, and local community members who communicated valuable socio-cultural and environmental information to each other and community residents. Topics included Federal Emergency Management Agency policies and flood insurance, scientific assessment of marsh vulnerability and restoration options, shoreline erosion and opportunities for building living shorelines, and religion, faith and climate change. These events allowed the public more access to the work of the DIMCP as well as to begin a larger dialog on relevant issues concerning resilience of the larger Deal Island Peninsula area.

Collaborative learning activities have been effective in establishing rapport within the project's network. While stakeholders do not always agree on the problems and solutions, they have learned and benefited from each other's views, particularly in relation to environmental and social vulnerabilities and resiliencies. In a survey following our last stakeholder workshop, thirty out of thirty-one project stakeholders said that they "strongly agree" or "agree" that "I have been able to share my

knowledge and expertise" through project activities (DIMCP Stakeholder Survey 2015). And, thirty-one out of thirty one project stakeholders said they "strongly agree" or "agree" that "I have learned from other's knowledge and expertise" (DIMCP Stakeholder Survey 2015). The ongoing collaborative learning commitment has served to establish rapport among the group, build new connections among the diverse subgroups of the stakeholder network, and contribute to shared knowledge and understanding of diverse system components, threats of vulnerability, and strengths of resilience.

Collaborative Science

Since the beginning of the DIMCP, social and natural science research activities have incorporated participation by the stakeholder network with collaborative science. The NERRS program defines collaborative science initiatives as "address[ing] coastal management problems that are high-priority issues for the reserves and coastal managers around the country" (NOAA Office for Coastal Management 2015). NOAA's science collaborative model brings scientists from across disciplines into relationship with local community members (NOAA Office for Coastal Management 2015). A key objective of this type of work is in integrating social science and natural science work alongside "human dimensions of management" (Robinson et al. 2012, 998). This work is necessary to better match ecological research and management recommendations with human constraints such as timescale, policy and management, economics, and cultural understanding (Goring et al. 2014).

A significant portion of project support went to academic research in the fields of ecology, anthropology, and economics. Social science data collection focused on local and system level understandings of climate change, vulnerability, resilience, heritage, and valuation of socio-ecological services. The DIMCP ecological research focused on marshes, and particularly on hydrological restoration of ditch-drained marshes. Marshes were ditched in the 1930s as a means to mitigate mosquitoes and facilitate salt hay harvesting. Ditch-plugging restoration was identified by a subset of the project stakeholders prior to the initiation of the project. Studying marsh systems before and after restoration was necessary to understand whether this would restore natural hydrology and improve habitat quality and marsh resilience, or increase vulnerability to sea-level rise. Data gathered relate to hydrology, mosquitoes, fish, plants, soils, and elevation change, with a focus on vulnerable components of the ecological system that may become more resilient through restoration activities (Needelman and Paolisso 2015). In each of these research components, additional emphasis was placed on developing interactive and collaborative exercises to share knowledge within the network. As a result, information exchange proceeded via a combination of traditional research and non-traditional stakeholder interaction. Collaborative research projects are a key example of our collaborative science activities.

Collaborative research projects (CRP) were developed through initial project stakeholder discussion at workshops. Three CRP groups of ten to fifteen stakeholders coalesced around topics related to flooding and shoreline erosion, marsh restoration, and community heritage. With an open research agenda, small groups conducted

facilitated activities, leading to the co-development of key research questions and paying attention to relevant features of vulnerability and resilience. For example, the marsh restoration CRP has conducted data collection on historical environmental change in the area and organized a field trip to share on-the-ground knowledge about the marsh between local community members and MD-DNR representatives. CRP research findings complement ongoing scientific research and provide a platform for social learning, particularly concerning stakeholder knowledge and values. Local knowledge was given equal consideration to scientific knowledge in these groups, aiding in the development of a shared and deeper understanding of complex socio-ecological problems and interactions and additional needs for future investigation.

These collaborative science research activities serve three purposes within the broader project. First, they build knowledge about the socio-ecological system and facilitate the sharing of this knowledge with project stakeholders and other community members through collaborative learning activities. Second, stakeholders learn how research is conducted by scientists and about how that research can be influenced through their involvement. Finally, they enable the heightened involvement of researchers who often have limited time available to participate in outreach activities. These activities provide opportunities for shared learning between researchers from the three scientific disciplines and between scientists and non-scientists within the stakeholder network.

The DIMCP and its goals of collaborative learning and collaborative science provided ample mechanisms for engaging with the people who inhabit, work within, are interested or invested in the community and surrounding landscape. In particular,

workshops and community conversations provided means for members of the public to access and share information about vulnerability and resilience to climate change in the Deal Island Peninsula area. Now that these more overt mechanisms have been described, the next section will further explore theory relevant to this work.

Chapter 5: Theoretical Underpinnings

Several important bodies of theory underlay the conceptual architecture of this dissertation. Some aspects of this theory have been covered in the chapter on engagement, but others are included here for further coverage. First, I would like to emphasize that I see mechanisms of engagement, theory, and method as interacting to inform the possibilities, scope, conduct, and analysis of research. And secondly, theory is developed to support understanding vulnerability and resilience from an ethnographic perspective and also to inform applied objectives of the DIMCP. Therefore, the reader will notice insights from several disciplines are brought together to offer perspective relevant to the DIMCP and the broader research agenda of understanding resilience to climate change for the Deal Island Peninsula area. Important bodies of work that inform this research are climate change anthropology, social-ecological systems, and resilience.

Anthropology of Climate Change

The application of anthropological theory and practice to diverse cultures and communities has improved global understanding of climate change. The field's insights on socio-cultural interactions and meaning help to expand the copious ecological and physical data related to our changing climate. Depth and diversity in exploring cultural meaning and social practice is a hallmark of anthropology, and is particularly applicable to the study of climate change. As noted by Roncoli and colleagues (2009):

> Anthropology's potential contributions to climate research are the description and analysis of these mediating layers of cultural meaning and

> social practice, which cannot be easily captured by methods of other disciplines, such as structured surveys and quantitative parameters. (Roncoli, Crane, and Orlove 2009, 87)

There are multiple ways anthropologists are able to contribute to studies related to environmental change. Roncoli, Crane and Orlove (2009) usefully categorize anthropology's activities into five interest areas: being there, perception, knowledge, valuation, and response. Each of these varies greatly in scale ranging from local to global knowledge as well as the emphasis on research, analysis, and applied outcomes. Of course these categories are not mutually exclusive, but rather point to particular emphases. In attending to this range of realities, anthropology brings all of the same disciplinary strengths to bear on climate change research.

Anthropology has a long tradition of research related to adaptation of cultures to their natural environments (Dove and Carpenter 2008; Barnes et al. 2013; Fiske et al. 2014). Building upon this and reaching out into new directions, climate change anthropology has been successful in documenting the experiences of local communities as they are facing and reacting to climate change impacts, and in contextualizing environmental change through time (Fiske et al. 2014). Examples of cultural meaning and social practice that anthropologists have focused on include: perceptions of environment and climate (Strauss and Orlove 2003; Rayner 2003), public opinion (Kempton, Boster, and Hartley 1996), local knowledge (Cruikshank 2010), the relationship of local knowledge to vulnerability, adaptive capacity, conservation objectives, and environmental justice (Miller Hesed and Paolisso 2015; Shaffer and Naiene 2011; Tschakert et al. 2014; Nadasdy 2004; Paolisso et al. 2012). In addition, climate change anthropology has blossomed in the study of comparative and broad ranging issues of vulnerability across the globe providing insights, for

example, on how island nations, coastal peoples, and Arctic communities are effected by climate change (Lazrus 2012; Oliver-Smith 2009; Cameron 2012). These diverse applications demonstrate only some of the ways that anthropologists have contributed to the study of climate change.

Crate and Nutall's (2009) edited volume is instructive in the range of anthropological engagement in climate change research from local to global and theoretical to more applied contributions. Contributions span multiple disciplinary interests and are limited not just to environmental anthropology but also incorporate concerns such as development, health, and politics. Anthropology has quickly and impressively tackled multiple issues related to climate change. An increasing number of anthropologists are now working at a global scale despite the discipline's traditional emphasis on place-based and local communities (Oliver-Smith 2012; Oliver-Smith et al. 2012). The global-ness of climate change means that it affects everyone, not only island nations or remote Arctic communities:

> The effects of climate change are happening now-not sometime in the distant future, like 2050-or in faraway places, but here in the US in a slow and insidious manner; sometimes with startling and prescient glimpses into the future, such as with SuperStorm Sandy. (Fiske 2012)

Anthropology has an important place in building and leveraging knowledge for future action through the work of applied and engaged anthropologists who tackle issues collaboratively with communities and others (e.g. Laska et al. 2010). I argue that there is a significant opportunity to pair engaged environmental anthropology and the anthropology of climate change through cooperative research with communities who are negotiating and determining their own futures on a local level.

This dissertation is informed by diverse findings from climate change and

environmental anthropology. I have adopted the following as key perspectives:

- traditional ecological knowledge has value in enhancing adaptation to global climate change (Ruiz-Mallen and Corbera 2013);
- climate change discourse can serve to obscure ongoing and underlying relationships between humans and nature (particularly in historic economic, social, and political contexts) (Nuttall 2009);
- existing vulnerabilities should be highlighted in addition to and as much as new and future vulnerabilities (Oliver-Smith et al. 2012);
- local level institutions are imperative to creating adaptation capacity and implementing adaptation efforts (Agrawal and Perrin 2008);
- anthropological insight should serve to inform vulnerability and adaptation solutions, rather than relying upon technology alone (Roncoli 2006);
- local community members readily connect vulnerabilities with "achievable" adaptation possibilities through their own and existing cognitive frameworks (Paolisso et al. 2012, 46);
- and that scientific information and global discourse on climate change is received and assimilated by local community members (Rudiak-Gould 2011).

These insights provide an important theoretical foundation regarding the relationship of climate change discourse, local knowledge, vulnerability, and adaptation. I see them as important to build upon in my engaged and multi-sited work in order to identify vulnerability and resilience as experienced in a local community and also a regional network via the DIMCP. As stressed by climate change anthropologist Susan Crate (2011):

> It is only through an integration of knowledge, from local to global, and via collaboration and cooperation across geographic, stakeholder, and geopolitical/socioeconomic scales that we will be able to reach understandings and find ways forward. (188)

Environmental anthropology, cultural anthropology, and other fields inform findings and theory produced by climate change anthropology. One strength of climate change anthropology (as with other subfields in anthropology) is in drawing upon multiple disciplines and even in working past anthropology's boundaries to incorporate relevant literature, theory, and methods. The brief introduction to climate change anthropology above outlines relevant theory within the discipline, but we

must also look outward. I find it useful to pair these understandings with theory and knowledge from both social-ecological systems and resilience research to more fully explore the implications of climate change for the Deal Island Peninsula area. Below I briefly explore theory related to social-ecological systems and give a summary view of the Deal Island Peninsula social-ecological system, then provide a more expansive discussion of resilience.

Social-Ecological Systems

Conceptualizing the Deal Island Peninsula area as a social-ecological system allows me to view system dynamics and frame the interaction of multiple system components more holistically. This framework pairs nicely with anthropology, particularly in cases of interdisciplinary and cross-disciplinary work. Social-ecological systems are "…ecological system[s] intricately linked with and affected by one or more social systems" (Anderies, Janssen, and Ostrom 2004, 3). This means that they are geographically grounded, take into account ecosystems dynamics, and attempt to incorporate information about ongoing social dynamics. Originating from complex adaptive systems thinking and the ecological sciences, social-ecological systems literature emphasizes emergent features of systems, non-linear dynamics, and disruption of reliance upon chain reactions and linear causal mechanisms (Lansing 2003; Holling 1973; Walker et al. 2006). It is an intentional means to add complexity, rather than simplicity, in viewing a coupled human-natural system.

There are multiple bodies of work and frameworks that fit under the broad category of social-ecological systems (Binder et al. 2013). Anthropologists have worked in this area for over forty years in the fields of systems ecology, new ecology,

social ecology, and later political ecology (Biersack 1999; Abel and Stepp 2003; Dove and Carpenter 2008). McCay's highly regarded work has emphasized the non-equilibrium states of systems, and the importance of looking at people and their problems first (McCay 1978; also seeVayda and Walters 2011). Framing systems as "social-ecological" helps to organize human and nonhuman entities across scales and emphasis on the whole system demands an interdisciplinary and fluid approach tailored to a particular issue. For this reason, social-ecological systems thinking is argued to be a good fit for anthropology:

> An interdisciplinary science that addresses itself to evolving systems with determinant processes at multiple scales of space and time could be a better fit for anthropology [than traditional positivist science]. (Abel and Stepp 2003, 9)

Abel and Stepp argued this point over a decade ago. Since then, there have been many developments in the application of social-ecological systems research, particularly in disciplines related to anthropology.

A popular example is the social-ecological systems framework (SESF) developed by Elinor Ostrom and others (reported in McGinnis and Ostrom 2014). Ostrom's goal was to "build a common vocabulary" and "logical linguistic structure" that could:

> …facilitate communication among scholars interested in the sustainability of [social-ecological systems], all of whom confront the daunting problem of developing a coherent mode of analysis to apply to complex, nested systems operating at multiple scales. (1)

The emphasis here is on the developing a standardized analytical framework that can be used simultaneously by multiple researchers in evaluating situations of common-pool management scenarios (3). In this type of analysis focus is on the resources used, the user, and its use, as well as governance systems and the ecological and socio-

economic contexts or "settings" in which action takes place (3). At the center of analysis is the "interactions and outcomes" that include diverse items including: evaluation, monitoring, harvesting, information sharing, conflicts and deliberation (3-5). Subsequent work has updated terminology (6-8). This and other frameworks vary in their treatment of the social and ecological systems: specifically in the way they conceptualize dynamic interactions between these two systems, and how equally analysis is weighted between them (Binder et al. 2013, 2). This is just one among many ways to utilize the concept of social-ecological systems.

Because there are multiple ways to utilize the concept, it is imperative to think critically about which framework can be best applied to the situation at hand (Binder et al. 2013; McGinnis and Ostrom 2014). In all cases, McGinnis and Ostrom (2014, 2) stress that framework users determine the relevant theory and parameters for use:

> Through their development and use of theories, analysts specify which of a framework's basic elements (and their interconnections) are particularly relevant to certain kinds of questions. Theories select for further analysis a subset of variables in a framework and make specific assumptions that are necessary for an analyst to diagnose phenomena, explain processes, and predict outcomes. Several theories are usually compatible with any framework.

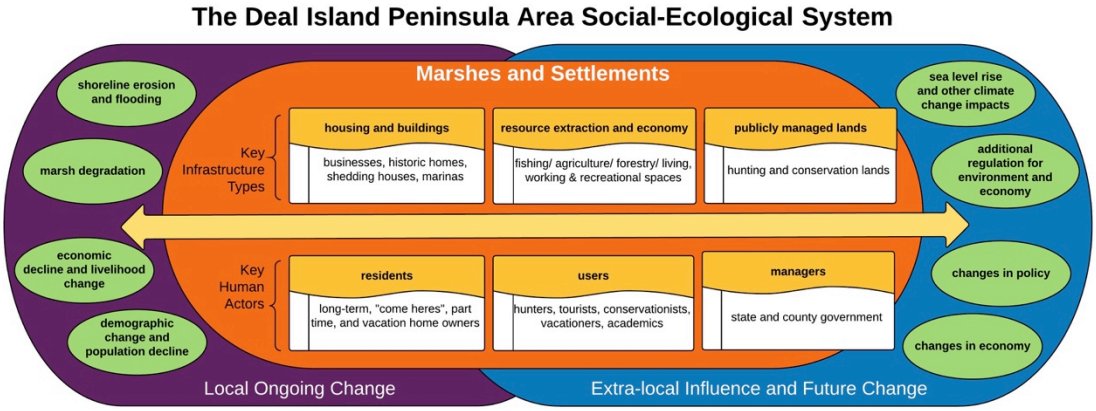
My definition of the Deal Island Peninsula area's social-ecological system is informed broadly by the literature outlined above. In addition, I have relied upon understandings from Walker and Salt's Resilience Thinking (2006) and Resilience Practice (2012). These two works are practice-oriented and describe how engagement in social-ecological systems can help the researcher to better define the system's structure. A key emphasis in this work is that while the parameters of a social-ecological system are based in the natural ecosystem, human constituents and their interactions within this system extend outward beyond the particular geographical

space. Conceptualization of the social-ecological system requires inclusion of natural agents, ecological processes, social agents and socio-economic processes, as well as complex interactions that ensue among these multiple levels that relate to environmental management, governance, and effects from climate change (Walker and Salt 2006; Walker and Salt 2012). While templates such as the work of Walker and Salt are available to help analyze the structure and organization of the system, ultimately it is a researcher's own context of work that helps delineate the system.

Through my engagement with the Deal Island Peninsula area and DIMCP, I have constructed a representation of the area's social-ecological system. The key components of interaction within the social-ecological system are noted in Figure 7. In this visualization, marshes and settlements are surrounded by local ongoing change and extra-local influences and future change. Key human actors in the system are residents, users, and managers. The key areas of infrastructure in the community are housing and buildings, resource extraction and economy, and publicly managed lands. The arrow is meant to signify multiple possibilities for interaction among these system components. This depiction of the social-ecological system highlights only key system components and key areas of change for the Deal Island Peninsula area. It does not describe in detail the interaction between these areas, which will be partially described in later chapters. However, this diagram does indicate features of local ongoing change (e.g. erosion, flooding, marsh degradation, economic and demographic decline) as well as features of extra-local influence and future change (e.g. climate change impacts, regulation, policy, economy). Thus, the social-ecological system is also situated in relationship with the past, present, and future. As

stressed earlier, this view of the social-ecological system is constructed specifically with a view toward defining vulnerability and resilience to climate change, rather than some other system function. The Deal Island Peninsula area social-ecological system is of course far more complex than can be represented in this diagram. However, it provides a clear way to conceptualize the dynamics of the area to better understand the relationship between various actors, infrastructure, and social and environmental processes, and to identify sources of vulnerability and resilience to climate change.

Figure 7: The Deal Island Peninsula Social-Ecological System



Created by K. Johnson

It is important to emphasize the particular way that social-ecological systems are being used here that spans the research-practice divide. The social-ecological system is both a convenient way to characterize the area from a research perspective, but also lends itself as a descriptive way to combine social and ecological concerns when talking to stakeholders and community members. This framework helps

produce conceptual holism, but we should remember that social-ecological systems are not only conceptual. Todd Crane (2010) makes a very important point:

> From a modeling perspective, a social–ecological system is a heuristic device, which can be conceptual or quantitative, and is constructed to help analyze the ways that multiple factors interact and result in specific outcomes. This reduction of complex interactions to mechanistic abstractions is useful, and perhaps even necessary, in developing recommendations for policy makers and identifying potential leverage points for technical or social innovations. However, from the perspective of people who make their living within it, a social–ecological system is more than just a useful heuristic construct. It is the very material, social and symbolic landscape that contextualizes and constitutes their lived experiences. This is not to say they would not recognize empirical components and mechanisms in abstract models, but that those models would be evaluated from positions situated within the system; positions that implicitly include normative values vis-à-vis empirical phenomena. (11)

Crane is arguing that social-ecological systems research is a tool, a heuristic device that reduces complexity, producing insight for academic analysis and managerial purposes. However, the social-ecological system is also a reality and lived experience for its inhabitants and therefore knowledge and understanding of the system is employed to make sense of it. This point is also made in a recent article by Manuel-Navarrete (2015) who proposes a "double coupling" within social-ecological systems to better represent subjective system dynamics. In double coupling, an additional feedback mechanism is modeled to account for intentionality, reflexivity and place-based specificity, which are overlooked in traditional social-ecological models that rely on linear effects from ecological systems to social systems and vice versa. Recent work such as this dissertation research demonstrates the ways in which social-ecological systems literature continues to evolve and become more relevant in the context of complex problems.

With this additional acknowledgment of subjectivity and experiential processes that inform social-ecological systems dynamics, the concept of social-

ecological systems is useful for research at the confluence of climate change and resilience. The social-ecological system, for the purposes of this dissertation, serves as a conceptual framework and practical communication tool. As discussed further in the next section, social-ecological systems theory is also very important to resilience theory and research.

Resilience

Resilience is a concept that has mushroomed in popularity and application to multiple facets of life (Brown 2014). It commonly refers to a good or desirable attribute of steadiness or ability to cope by human and non-human actors. Although resilience is utilized across academic disciplines, popular media, public discourse, and is an important feature of policy and activism regarding environmental change, it is not intrinsically positive (or desirable and good) as will be discussed later. Resilience is both culturally and scientifically important and plays a key role in climate change adaptation discourse. Resilience has been applied across many varied disciplines, including psychology, ecology, disasters research, and governance (Brown 2014). Exploring some of these varied uses of resilience will give better insight on what resilience may mean for the Deal Island Peninsula area.

Resilience theorists and those who employ resilience as a conceptual tool in engaged research, for example environmental management or climate change adaptation, acknowledge the diverse ways in which resilience is conceptualized and applied outside of disciplinary theorization. The meaning of the term and its application has changed over time. Alexander (2013) provides and a very interesting

etymology of resilience extending back to Greek and Roman times[2]. He also points out an important disjuncture regarding the resilience concept, noting:

> …it is striking how the term is used in different disciplines without any reference to how it is employed in other fields, as if there were nothing to learn or transfer from one branch of science to another. (2713)

And indeed, Baggio, Brown, and Hellebrandt's (2015) citation network analysis supports this, revealing that resilience is not an effective bridging concept between disciplines except within social-ecological systems research. Yet there are many ways that different uses of resilience may inform work related to climate change. A few of these are discussed here.

Resilience Applied

Resilience is used in multiple contexts in the public sphere, but has a similar underlying meaning. Davoudi and Porter (2012) call it the "discourse of bounce-back-ability" (301). Starting on the most practical level, resilience has to do with meeting needs imposed by disturbance. The Obama Adminstration defines climate change resilience at a national level as the development of a plan to reduce carbon pollution and support clean energy plans (The White House 2016). NOAA (2015, 1) defines resilience on an individual and community level as "…our ability to prevent a short-term hazard event from turning into a long-term community-wide disaster." In both cases, resilience is not about preventing disaster (although that can also be included) but about coping with future impacts. Coastal areas like the Deal Island Peninsula area are prone to hazardous events, and the ability of a community to deal with these

[2] Alexander provides a disciplinary evolution of resilience's adoption and "positions" resilience schematically within the sciences based upon their reliance upon social, psychological, physical, and technical attributes (Alexander 2013, 1283-1284).

types of disasters constitutes coastal resilience, which NOAA defines as "building the ability of a community to "bounce back" after hazardous events such as hurricanes, coastal storms, and flooding – rather than simply reacting to impacts" (2015, 1). A not-quite-explicit feature of this understanding of coastal resilience is that there is a difference between "bouncing back" and reacting, where bouncing back requires planning and action beforehand. Ease and success in getting back to normal are the primary objectives. This definition does not position the "bouncing back" in the context of uncertainty (such as that surrounding climate change), but very clearly within the scope of expected and experienced perturbations. It seeks to help people plan for the future by anticipating known hazards and threats. This type of discourse is very much about what we *already know* and how we can apply it in situations of future uncertainty.

Psychological Resilience

Another type of resilience that is important to mention is psychological resilience. Here, resilience is applied in contexts of trauma, where the fitness and success of the subject had to do more than just chance (Jarrett 1997). Earlier work tended to focus on the resilience of the individual to withstand difficult times, but more recent work emphasizes the resilience of communities (Buikstra et al. 2010; Gotham and Campanella 2013). Much of this work takes place at the interface of resilience, ecological disturbance, and psychological health (Alston 2006; Stain et al. 2011). This kind of resilience helps us to identify the features producing successful responses despite the negative experiences endured. Even within the field of psychology though, the application and use of resilience is contested and conflicting

(Luthar, Cicchetti, and Becker 2000). However, at its core, this area of resilience studies emphasizes the importance of understanding the properties of the individual or community that allow them to weather stress and disturbance successfully.

Social-Ecological Resilience

Resilience theory was first applied to ecological systems by Holling (1973), who said, "Resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist" (17). This would later be called 'engineering resilience' (Folke et al. 2010). Here, resilience describes the ability of self-organizing systems to tend toward persistence of specific states, rather than total system equilibrium (Holling 1973). Holling highlights the need for adaptive management with regard to these types of systems in order to accommodate unexpected events. This conceptualization of resilience transitioned quickly from use in the field of ecology into complex systems theory (see Folke et al. 2010). However, it was not until later that social-science researchers introduced the importance of social dynamics to complex adaptive systems functionality, and set the stage for robust inquiries into the resilience of social-ecological systems (Folke 2006). Adaptive management again became an important feature in social-ecological studies of resilience when emphasis was placed on the role of management regimes and social institutions in controlling and responding to ecosystem states (Folke 2006).

As social-ecological resilience evolved, resilience became "the ability to cope with shocks and keep functioning in much the same kind of way" (Walker and Salt 2012, 3). In this interactive systems arrangement, resilience is dependent upon system

components and is controlled by whether the system has crossed important social, ecological, or decision-making thresholds. Resilience operates by sustaining the relationships and functionalities of key system components, thereby enabling the system to persist. As such, resilience is a dynamic context-based and emergent property of a system, rather than a system product (2012). Key system features important to building resilience include: diversity, ecological variability, modularity, acknowledging slow variables, tight feedbacks, social capital, innovation, overlap in governance, ecosystem services, fairness/equity, and humility (2012).

Social-ecological resilience exists on two levels: generalized and specified resilience. Generalized resilience refers to the health of the overall system, whereas specified resilience deals with important system components (Walker and Salt 2012). The assessment of generalized resilience is key to planning for and building system resilience, but theory related to this concept is not well developed (2012). It is nearly impossible to quantify generalized resilience due to the interaction of multiple system components (Walker and Salt 2012, 92). Unlike specified resilience, generalized resilience is not about preparing for small scale and specific threats, but about "maintain a large safe operating space" to deal with shocks across the system (100). Thus, generalized resilience is not about system rigidity; rather it is about embracing change in order to maintain a sustainable or desired state. Nykvist and von Heland (2014) point to the importance of considering the role of memory in fostering or hindering generalized or specified resilience. The authors discuss social-ecological memory as leading to community coherence and barriers to adoption of new practices. To address this, they suggest managers shift to greater emphasis on

generalized social-ecological memory in order to create new pathways to avoid old path dependencies leading to undesirable specified resiliencies.

Viewing resilience through social-ecological systems aids in the development of holistic and complex perspectives, thereby giving more equal footing to environmental and social concerns (Adger 2000; Folke 2006). In paired relationship with resilience, the social-ecological system framework allows exploration of system features, dynamics and feedbacks between those features, and also supports institutions, arrangements, and relationships between people and their environment. Emphasis is being increasingly placed on the creation of participatory processes that allow people to participate in managing their own social-ecological systems, moving more into the realm of adaptive management and adaptation planning (Walker et al. 2002; Walker and Salt 2006; Walker and Salt 2012).

A social-ecological resilience framework broadens the expanse of adaptation while also providing space for agency (Nelson, Adger and Brown 2007: 412). A view across the larger scale means that there are more options for solutions moving forward and more potential sources to rely upon in developing cooperative and interactive solutions. Therefore socio-cultural interaction within the context of social-ecological resilience is an important site for negotiating adaptation and vulnerability (Adger et al. 2009). This is where the method and theory of collaborative learning is applicable, as it provides a tool to work toward future environmental governance (Daniels and Walker 2001; Feurt 2012). With the understanding that features of vulnerability and potential adaptations are negotiated within contexts of building resilience it is extremely important for anthropologists to contribute to more detailed

analysis of social-ecological resilience as a process as well as a system attribute. Theorization of resilience alongside social-ecological systems dynamics is useful but still limits considerations of how systems accommodate change as resilience in this context is for the most part approached as coping with shocks and returning to the system's original state.

Resilience as Transformability

Another useful theoretical approach to resilience focuses on the importance of social change in managing for resilient systems. Folke et al. (2010) argue that "social change is essential for social-ecological system resilience" (2). This social change enables reorganization of the system and typically takes two forms: adaptive capacity and transformation. While adaptive capacity is the "capacity to respond" (Gallopin 2006, 296), transformability is:

> The capacity to transform the stability landscape itself in order to become a different kind of system, to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable. (Folke et al. 2010, 3)

It should be noted that transformation can be both unanticipated (as in the case of system collapse) or created through "directed efforts" for system improvements (Nelson 2011, 116). The directed effort type is discussed here. In work addressing the adaptation of institutions and other social organizations, another definition for resilience emerges, as "…the ability to reorganise following crisis, continuing to learn, evolving with the same identity and function, and also innovating and sowing the seeds for transformation" (Boyd and Folke 2012, 266). This definition positions resilience as something humans use to adapt, reorganize, and learn how to accommodate future change. Resilience in this sense is about maintaining the

community's way of doing things, but also about changing when necessary. In fact, Boyd and Folke acknowledge that a community may not be able return to the same state of affairs but keep some of their same identity moving forward. Collective action and change are inherent components of this form of resilience. Defining resilience this way is useful to emphasize system dynamics and adaptation as well as coping and potential transformation. This flexibility lends itself well to the uncertain threats from climate change that areas such as the Deal Island Peninsula area face.

Community Resilience

A new development within resilience studies is a focus on "community resilience" (Amundsen 2012; Buikstra et al. 2010). This resilience literature draws from developments between social-ecological systems and resilience theory, and is most closely related to social resilience. Community resilience is very applicable to the way that I conceptualize my work on the Deal Island Peninsula, except that it does not incorporate features of the environment or environmental dynamics as forms of resilience. Therefore, I explore community resilience briefly here to provide a counterpart to the ecologically rich social-ecological systems resilience ideas. Community resilience is defined as:

> …the ability of a community to cope and adjust to stresses caused by social, political, and environmental change and to engage community resources to overcome adversity and take advantage of opportunities in response to change" (Amundsen 2012, 1)

This definition is similar to others, but focuses specifically on the social aspects of the system and a community's ability to respond. In her study of an Arctic Norwegian community, Amundsen builds upon the work of other researchers (e.g., Buikstra et al. 2010, Magis 2010, Ross et al. 2010) to highlight six dimensions of community

resilience: "…community resources, community networks, institutions and services, people–place connections, active agents, and learning" (1). These dimensions are highly related to the interactions of individuals, institutions, and social networks in concert with one another. Community resilience research such as this is unique because it is qualitative rather than quantitative and emphasizes reflexive learning as an important component of community resilience (1,4). Amundsen makes an important point to consider in the context of climate change and environmental change in stating that the resilience that is relevant today may not be relevant tomorrow, and that we should consider whether today's resiliency may lead to complacency (Amundsen 2012, 9-10). Amundsen's work provides a good example of the complexities of social dynamics with regard to resilience, and the complications of applying community resilience factors alongside uncertainty with climate change in the future.

Community resilience research gives a clear picture of empirically based and contextualized understandings of resilience:

> …our ethnographic field observations and interviews point to the multidimensionality of resilience in which resident perceptions show resilience to be heterogeneous, conflictual, and contested. The malleability and fluidity of resilience emanates from stakeholders' different and sometimes competing notions of their neighborhood's identity. (Gotham and Campanella 2013, 312-313)

The dynamism inherent to community resilience means researchers each look at community resilience somewhat differently. For example, Buikstra et al. 2010 use participatory action research to investigate community and individual resilience in rural Australia and find eleven types of resilience stemming from interactions between individuals, the community and the environment. These include:

> …social networks and support; a positive outlook; learning; early experiences; environment and lifestyle; infrastructure and support services; sense of purpose; diverse and innovative economy; embracing differences; beliefs; and leadership. (Buikstra et al. 2010, 981)

Though similar what Amundsen (2012) identifies as the foundations of community resilience, Buikstra et al. also include beliefs and early life experiences as two additional components to consider. This community resilience is related to the specific case at hand and may not be universally applicable.

A few other examples of community resilience, however, attempt to locate community resilience on a larger scale. Their comparison may help to clarify the utility and comparability of this work across the field. Ross et al. (2010) identify six regional and community level indicators of social resilience stemming from comparative work at both the regional and local level in Queensland, Australia[3]. This research demonstrates the feasibility of up-scaling local community resilience assessments. In another example from Australia, Mcaslan (2011) identifies and discusses three forms of "capital" that support community resilience: physical, procedural, and social (9-11). Mcaslan and the Torrens Resilience Institute plan to partner with local communities and municipalities to build community resilience through assessment of these "enablers of resilience" (9). And finally, in an effort to create an even broader application for community resilience, Magis (2010) offers standardized dimensions of community resilience to assess social sustainability across contexts. She hopes that these dimensions can be used for community self-

[3] The indicators are: knowledge, skills and learning, community networks, people-place connections, community infrastructure (services and facilities), diverse and innovative economy, and engaged governance (Ross et al. 2010, 107).

assessments as well to help guide grant funding opportunities and decisions[4]. Overall, there is a sliding scale between contextual specificity (e.g., Amundsen 2012 and Buikstra et al. 2010) and universal applicability (Mcaslan 2011; Magis 2010) for work in the field of community resilience. While I find it useful to think about what larger and more comparative categories for community resilience offer, resiliencies identified in Chapter 8 of this dissertation correspond more closely with the more contextually specific and incorporate significant emphasis on environmental as well as social factors.

Critiques of Resilience

Information above on the theorization of the resilience concept should give the reader some indication of the multiple ways that resilience has both been characterized and utilized across several disciplines. As it is applied to climate change adaptation, resilience is generally positioned as an overwhelmingly positive system attribute (Davoudi and Porter 2012; Alston 2006; Walker and Salt 2012; Amundsen 2012). Resilience is both a system attribute and a conceptual tool to discuss system, community, ecological, social, and individual properties. As such, resilience is an analytical category for past, present, future, and imagined states. Cote and Nightingale (2012) describe the blurred boundaries that resilience often crosses this way:

> …when we tread into the domain of what 'ought' to be, we have moved firmly out of the science of description and prediction as it is understood today and into moral and ethical terrain. In this sense resilience thinking is

[4] The eight "dimensions of resilience" include: community resources, development of community resources, engagement of community resources, active agents, collective and strategic action, equity, and impact (Magis 2010, 410-412).

> a power-laden framing that creates certain windows of visibility on the processes of change while obscuring others. (484-485)

Resilience, as ecological and social-ecological theory reminds us, is not inherently positive or negative. What it means to be resilient and who decides is an ethical matter with moral implications that should be discussed as part and parcel of both the analysis of resilience, and decisions for adaptation and transformation.

Cote and Nightingale (2012) make the point that resilience has been used without clarity and critical awareness of the positioning of specific parties, particularly with reference to studies of governance and adaptive management in social-ecological systems (479). Assessment of social resilience in social-ecological systems has placed considerable emphasis on social institutions, formal networks, structures of governance, and organizational agency (i.e., the work of Ostrom 2009 and others). But, Cote and Nightingale emphasize a need to move away from the institutional as a proxy for all social resilience (480). The social realities are far more complex than research and understanding of social institutions alone can provide, as is demonstrated by the community resilience researchers. There is more complexity and additional knowledge needed, particularly that of the ethnographic variety. Shaw (quoted in Davoudi et al. 2012) nicely describes this challenge in stating:

> Whatever the wider institutional or strategic implications of applying the resilience framework to planning theory and practice, perhaps it is ultimately the human dimension, based on an intuitive, "sense-making", approach to unfamiliar or chaotic situations that remains the crucial challenge in an era of profound uncertainty. (311)

To remedy this situation, Davoudi and Porter (2012) advocate that we pay more attention to critiques from the social sciences about the importance of agency, power, and knowledge. Cote and Nightingale describe their situated resilience approach as

moving away from an emphasis on functionalism and abstraction to place more attention on the processes and relationships of knowledge-making, power, and agency inherent to system dynamics (Cote and Nightingale 2012). There is an obvious role for qualitative investigation, anthropological insight, and ethnographic focus, which can address these critiques by providing a means to contextualize resilience within social-ecological systems through a holistic and place-based focus. Such work can better contextualize social-ecological system resilience and acknowledge changing dynamics and the important role of knowledge, power, and agency in shaping particular realities.

Implications for Adaptation

Academics, managers, and planners have adopted the concept of resilience as a means to help orchestrate positive outcomes in situations of social-environmental complexity. Work is devoted to understanding what confers resilience or what attributes can strengthen resilience. Defining resilience within a robust and complex systems context increases understanding of vulnerability and adaptation through the inclusion of additional socio-cultural factors and broadened research agenda (Nelson, Adger, and Brown 2007). Additional socio-cultural factors can reveal tensions in environmental and social relations, and historically or politically constructed processes and insights. Particularly with regard to climate change a historical perspective "direct[s] attention to root causes and the fundamentals of vulnerability and resilience as long-term processes [rather than only as the result of climate change]" (Kelman, Gaillard, and Mercer 2015, 25). As anthropologists have pointed out, vulnerabilities can be systemically embedded in socio-ecological systems due to

inequitable distributions of resources, wealth, and security (Oliver-Smith 2013). With a system-oriented approach individual and group knowledge, values, as well as practices can be investigated and contextualized in relation to both climate change vulnerabilities and adaptations (Oliver-Smith 2013; Orlove 2009). This not only increases the potential for adaptation strategies, but can also contribute to more successful adaptation planning since information is more robust.

However, the uncertainty of climate change means that we may be affected in new and different ways. How we recognize and prioritize resilience both now and in the future has implications for social-ecological system interactions and resilience outcomes. As Weichselgartner and Kelman (2014) note:

> Since the way we think about terms influences where we look for solutions, and the shape and character of the means we use to attain those solutions, a starting point for potential change lies in disclosing the full range of resilience thinking and embracing the frequently ignored social-political aspects. (260)

Particular humans with specific perspectives decide what constitutes a desired outcome for resilience across the social-ecological system. How we respond will matter more to some within the social-ecological system. Additional work is needed to better understand complexities of resilience as an organic and contextualized process within an empirical case study. This dissertation seeks to fill this gap. Fuller exploration of vulnerability and resilience at a mid-range scale, where analytical concepts meet local understandings, is necessary for effective and engaged environmental anthropology to better bridge the gaps between the viewed model and lived experience (Buikstra et al. 2010; Ross et al. 2010; Maclean, Cuthill, and Ross 2014; Nuttall 2009). For example, McCubbin, Smit, and Pearce (2015) argue that planning through the use of future climate scenarios may draw attention away from

existing and more immediate vulnerabilities and stresses they have been identified for local communities in Funafuti, Tuvalu (53). The question they are asking is not 'What will happen with climate change?' but rather '"Where does climate fit" within the complexity of locally-lived lives?' (53). Work with communities such as this (also see Ford et al. 2006) highlights the importance of understanding social and community resilience and vulnerability, and incorporates these understandings with academic interpretations of resilience to respond to physical threats and impacts. In an engaged context this perspective allows individuals and communities to define goals for the socio-ecological system and work together to achieve them, broadening potential of effective environmental governance through planning and adaptation, while also providing space for fostering different forms of agency (Nelson, Adger, and Brown 2007).

Linking theory to mechanisms for engagement and also to research methodologies in clear pathways is critical. I would therefore like to draw in an additional source of insight about the relationships between these components. Curtin (2014) discusses what he calls "resilience design." His focus is on adaptive problem solving for conservation and natural resources stewardship. He lays out a conceptual framework that seeks to synthesize cognition, learning, and collaboration in pursuit of these activities. There are three key messages that are important to translate to the Deal Island Peninsula area. First, learning is an iterative and repeating process that follows a series of stages involving experience, observation, conceptualization and experimentation (Curtin 2014, 4). Second, learning occurs not only for individuals but also for institutions, and leads to shifts in identity as well as worldview (Curtin 2014,

4). And finally, Curtin importantly distinguishes between designing for process (i.e. learning and collaboration) and designing for outcomes (i.e. developing resilience to *x*). He argues that both need copious and intentional consideration in navigating cases with complex multi-scalar interactions to promote resilience. I employed iterative learning approaches in this dissertation, and it informs my conceptualization of the social-ecological system as a dynamic rather than static entity. In addition, I find that the individual-and-institutional learning to be extremely important to apply in this case study where I analyze DIMCP stakeholder interviews, stakeholder subgroups (researchers, local residents, environmental managers and others), and locals vs. nonlocal participants with the recognition that each are also composed of individuals with diverse experiences.

This chapter outlines theory related to anthropology of climate change, social-ecological systems, and resilience, providing the context and background for explaining how my research and theoretical positions have come to be situated at the intersections of these three fields. My overall objective is to use mechanisms of engagement and research methodologies (discussed in the next chapter) to provide insight on resilience to climate change for the Deal Island Peninsula social-ecological system. The type of resilience that I elucidate does not fit simply within social-ecological resilience or community resilience literature. Rather, it seeks to span these categories and introduce additional insights related to psychological resilience and the application of resilience in real world scenarios. Keeping in mind critiques of the resilience literature, this research also seeks to shed light on the value of approaching resilience within situated empirically-based contexts for supporting subsequent

adaptation planning. This type of research will contribute to anthropology of climate change by asking: What does resilience to climate change mean for the people of the Deal Island Peninsula area? Before answering this question, I will outline methodologies used to conduct the research.

Chapter 6: Research Methodologies

Data for this dissertation were gathered over a three and a half year period, from September 2012 to January 2016. My participation as a researcher on the DIMCP enabled interaction with local community members and network stakeholders both during and outside of project activities. It is important to reiterate that I do not understand the object of my ethnographic inquiry is not only to understand local community perspectives, but also those of the full and extended network of the Deal Island Peninsula area social-ecological system. The DIMCP's stakeholder group provides a representation of that network and consists of over fifty individuals who are from or currently live or work in the area, or who do work related to the Deal Island Peninsula area. Human subjects research approval was secured for this project through the University of Maryland (IRB# 368456-3: "Integrating Socio-Ecological Research and Collaborative Learning to Promote Marsh and Community Resilience") under the supervision Dr. Michael Paolisso as Principal Investigator.

My "research site" extends across spatial scales to include both the local area of the Deal Island Peninsula as well as more distant sites of work and research of other members of the DIMCP stakeholder network (see additional information on multi-sited ethnography below). Association with the Project's stakeholder network was sustained through participation in workshops, collaborative research projects, as well as public Community Conversations and other activities as detailed in the collaborative learning and collaborative science sections in Chapter 4. These interactions lead to a number of opportunities for data collection. Specific methods utilized include: multi-sited ethnography, participant-observation, semi-structured

interviewing and text analysis, structured interviewing, and cultural domain analysis. Each of these methods will be described in detail after a discussion of my overall methodological approach: multi-sited ethnography.

Multi-Sited Ethnography

Ethnographic research and insight has been a mainstay of anthropology for generations. It is utilized alongside fieldwork and participant observation to define local sense of place and worldview (Lassiter 2014; Balée 2012). "Being there" provides "insights into the way livelihoods are infused with cultural meanings and adaptations reflect agency in the way people endeavor to make the best out of their circumstances" (Roncoli, Crane, and Orlove 2009, 88). Gaining embedded and place-based knowledge via qualitative and quantitative data has produced rich insight into cultures around the world. I chose to use multi-sited ethnography as a research guide because it enlarges the scope of the traditional anthropological study site, enabling research at multiple locations (Marcus 1995; Falzon 2009). The mobile-ness of multi-sited ethnography allows for a fundamentally different focus than culture and community based field sites. Instead of focusing on one group of people, multi-sited ethnography is strategically designed to investigate linkages. As Marcus (1995) puts it: "Strategies of quite literally following connections, associations, and putative relationships are thus at the very heart of designing multi-sited ethnographic research" (97). In the case of my work in the Deal Island Peninsula area, the underlying connection between myself and the researchers and stakeholders working on the DIMCP is an interest in resilience to climate change for the area.

This interest is not only research based, relating to vulnerability and resilience to climate change in a local community, but also an applied interest in producing resilience to climate change for a social-ecological system. Therefore, I employ two lenses of ethnography, looking at the local community as well as the broader associations and arrangements related to the work of the DIMCP. My positioning at the University of Maryland enabled access both to researchers and environmental mangers and was critical for the success of my research. In order to plan and execute collaborative activities involving the local community I needed to be able to meet and plan with the rest of the project team. This positioning allowed my participation in multiple levels of the DIMCP and allowed for my interactions with local community members to be conducted alongside project activities at key junctures. For example, semi-structured interviews (discussed in more detail below) occurred after initial DIMCP meetings to allow stakeholders to become comfortable with me as a researcher, and to better understand the Project as well as share their knowledge on vulnerability and resilience.

Multi-sited ethnography must be clearly delineated and well positioned in order to be effective. This type of ethnography is both deep and wide:

> The strategically situated ethnography attempts to understand something broadly about the system in ethnographic terms as much as it does its local subjects: It is only local circumstantially, thus situating itself in a context or field quite differently than does other single-site ethnography. (Marcus 1995, 111)

Attempts to understand resilience across the Deal Island Peninsula area has been coupled with more specific ethnographic focus on vulnerability and resilience for the local community. This is precarious territory. Multi-sited ethnography has been critiqued for its shallowness and disregard for anthropology's standard practice of

participant observation (which will be discussed further below) (Falzon 2009). However, Falzon argues that when warranted due to spatial movement, or other conditions, the coverage multi-sited ethnography is able to achieve allows it to produce a knowledge with unique depth that crosses traditional barriers (Falzon 2009). In this case it is my hope that my positioning and flexibility has allowed me to gain knowledge and insight on multiple levels within the Deal Island Peninsula area's social-ecological system that would not have been possible only through place-based positioning.

Participant Observation

This data collection technique is both highly regarded and utilized extensively by anthropologists. The method requires participation and observation in both informal and formal activities and settings. Resulting understandings gained by the ethnographer or researcher include both subjective and objective knowledge related to a given topic of study. DeWalt and DeWalt (2002) define participant observation as:

> [when] a researcher takes part in the daily activities, rituals, interactions, and events of a group of people as one of the means of learning the explicit and tacit aspects of their life routines and their culture. (1)

This approach is particularly valuable in producing broad ethnographic insight and awareness of routine interaction. Participant-observation is a mechanism allowing a more dynamic and surprising data collection process through which the ethnographer's engagement enables their insight (Agar 1996). Participant observation is the mechanism through which all other information not elicited through formal data collection techniques is acquired and analyzed by the ethnographer.

Although I did not live in the local community, I utilized the technique of

participant-observation during many interactions with the DIMCP stakeholder network and local community members. Participant observation opportunities included DIMCP planning meetings, workshops, community conversations, public festivals, local community meetings, semi-structured interview settings, and unplanned interaction with DIMCP stakeholders (including local community members). In this case, information gathered through participant observation conducted at DIMCP activities helped formulate key understandings guiding this dissertation. In addition, it played a key role in the design of collaborative learning and collaborative learning activities for the DIMCP and in the design of the research methodologies described below.

Semi-Structured Interviews

A semi-structured interview is one in which the interviewer asks pre-determined questions, but follows up on the interviewees responses in a way that leads to new or additional information that the interviewee finds important or noteworthy (Bernard 2006). The semi-structured interview format was chosen for the DIMCP stakeholder network for several reasons. First, semi-structured interviews are less formal than structured interviews, and the comfort of individuals unaccustomed to interviewing situations was important. Second, the semi-structured interview allows for a more conversational format. This helps to situate knowledge, information, perceptions, and understandings within: "…a larger fabric of social life and cultural beliefs" (Luttrell 2005, 245). And third, unlike in structured interviews semi-structured interviews allow for information to come "into play" and be utilized relationally and with context by the interviewee rather than simply discussed

(D'Andrade 2005, 90). For example, an interviewee may bring up an anecdote that illustrates his or her point in a semi-structured interview. This additional information may give clues and clarifying context about what the interviewee meant by his or her previous statements.

Nineteen semi-structured interviews were conducted with twenty-five project stakeholders and community residents between March and July of 2014 (these are called "DIMCP Interviews 2014" in this document). This meant that stakeholders had some initial familiarity with the DIMCP and myself as a researcher. Many of the semi-structured interviews were conducted one-on-one, but in a few cases two or more individuals were present. The interviewees were chosen to represent particular stakeholder groups within the DIMCP, e.g., grant project leaders and researchers, local community members, and officials and managers representing governmental and non-profit interests in environmental governance. Twelve local community members, eight grant-funded leaders and researchers, and five officials and managers participated in the interviews. A significant proportion of the DIMCP stakeholder network is represented directly through semi-structured interview data and each main stakeholder type is indirectly represented through key participants.

The purpose of the interviews was to collect information on interviewees understanding of vulnerabilities and resiliencies for the area with regard to climate change. The following questions exemplify the focus of the interview: "What are the social or ecological features that make the Peninsula vulnerable to climate change?" and "What are the most resilient features of the Deal Island Peninsula? The least resilient?" A full list of questions for the interview tool is included as Appendix C. In

the semi-structured interview situation, I tried as much as possible to emphasize to the interviewee that they should interpret the questions using their own frame of reference. While I acknowledge their participation in the DIMCP could have influenced the way they defined terms (in particular vulnerability and resilience), I feel confident that their individual experiential knowledge proved to be more important for discerning how they identified these items in the context of the Deal Island Peninsula area.

Each semi-structured interview lasted between sixty and ninety minutes. Interviews were audio recorded and I took brief notes during the interview. Notes were scanned and included with the transcribed audio records for each interview. The transcripts and notes from the interviews were loaded to Atlas.ti and organized for thematic text analysis (Ryan and Bernard 2003). Each interview was coded deductively (DeWalt and DeWalt 2002) utilizing the key research topics: climate change, vulnerability, and resilience. Sub-codes were created for topics based on the emphases of interview questions. While much of the coding corresponded to the specific question asked during the semi-structured interview, there was often information gathered elsewhere during the interview that could also be coded under that topic (e.g. when talking about what a personal effect from climate change was, a person may also give information related to their view of "what is climate change"). The primary codes used were:

Table 1: Codes used for Semi-Structured Interview Text Analysis

Topic:	**Codes:**
Climate change:	what is climate change threat from climate change adapt to climate change personal effect from climate change
Resilience:	build resilience & opportunity for building resilience constraints to resilience Deal Island area resilience & existing resilience personal resilience
Vulnerability:	social vulnerability ecological vulnerability fix vulnerability

Then, interviews were coded inductively utilizing a variety of themes that came from the interviews themselves This type of coding is called "in vivo" coding (Bernard 2006) and resulted in items such as "lack of jobs" and "low incomes" that describe themes that more than one person mentioned for social vulnerability. Ultimately, this process produced a list of forty-one vulnerabilities (included as Appendix D) and thirty-seven resiliencies identified for the Deal Island Peninsula area by the entire DIMCP stakeholder network (included as Appendix E). As coding became more complex, I also created additional summary codes for conceptual simplicity, for example using "weak economics" to represent both "lack of jobs" and "low incomes." This summary list of vulnerabilities and resiliencies was produced for project activities and to share with DIMCP stakeholders and is included as Appendix F. The vulnerabilities and resiliencies will be discussed further in Chapters 7 through 10. The semi-structured interviews are the most important dataset for this dissertation and offer detailed insight into DIMCP stakeholder views of climate change resilience.

Structured Interview Questions

In a DIMPC workshop in February 2015, an activity was designed to get real time response to questions posed to the stakeholder network. While only a portion of the full network attended this workshop, important information was gathered regarding views across the social-ecological system. The activity focused on vulnerability and resilience in the Deal Island Peninsula area, and utilized codes and terminology I identified through the semi-structured interviews. Dr. Christine Feurt facilitated this activity that was conducted at a February 2015 workshop. Twenty-seven participants participated in the structured interview activity related to vulnerability and resiliencies across the Deal Island Peninsula social-ecological system. The questions asked during this interview are summarized in Appendix I. Nine were local residents, nine DIMCP leaders or researchers, and eleven were officials and managers with governmental or non-profit organizations.

During the activity, each participant was provided with a hand held device, or "clicker" with which they could select an answer to a multiple-choice question. The questions were displayed on a screen at the front of the room using a powerpoint presentation. As Dr. Feurt guided participants through the questions they were able to immediately select answers to questions. Their answers were kept anonymous and aggregated for everyone to see on the screen at the front of the room on a bar graph showing the percentage selecting each choice. The results of the structured interview activity will be discussed more in Chapter 10.

Cultural Domain Analysis

Cultural domain analysis assesses the similarities and differences stakeholders had across the cultural domain of "vulnerability and resilience to climate change." Stemming from research in the cognitive sciences, cultural domain analysis combines a host of techniques to assess group knowledge regarding a topic (Borgatti 1994; Borgatti 1998). To better understand how DIMCP stakeholders understand the interrelationship between vulnerability and resilience we developed a pile sort activity for stakeholders and paired this with multi-dimensional scaling analysis. A "pile sort" is a fun and interactive way to engage people in defining the relationship of items within a specified cultural domain (Borgatti 1998). The multi-dimensional scaling (MDS) analysis allows the researcher to produce a visual representation of how closely participants (as a whole) associate terms or objects with one another (Bernard 2006; Borgatti 1994).

Twenty-two vulnerabilities and resiliencies were included as pile sort terms. These items were derived from the condensed list of vulnerabilities and resiliencies developed from the DIMCP stakeholder interviews. The list of pile sort terms can be found as Appendix H. Each of the terms below was printed on a small piece of paper and stakeholders were asked to group the terms into as many piles as they deemed appropriate. They were instructed that they could organize their piles in any ways they desired and that they did not need to categorize their piles to fit the way that vulnerability and resilience were discussed in other project activities. They were also told to organize their piles so that terms in one pile were more similar to each other than to terms in another pile (DIMCP Workshop February 2015 & pile sort mailing Spring 2015). This method of pile sorting is called "free pile sorts" and was

developed in the 1960's to use alongside multidimensional scaling and hierarchical clustering to analyze domains of cultural information (Bernard 2006, 311). After participants sorted the terms into piles, each pile was stapled to mark it as a complete pile, and each participant placed their piles into a separate envelope. The pile sort terms were each given an identifying number and coded for input into the multi-dimensional scaling (MDS) program, Anthropac (Borgatti 1996). In total, forty-two DIMCP stakeholders completed the cultural domain analysis. This number includes fifteen local stakeholders, ten stakeholders who participated in DIMCP leadership or scientific research, and seventeen officials and managers from governmental and non-profit organizations.

The quantitative analysis of non-numbered items is performed with non-metric multidimensional scaling (MDS) using the computer program UCINET (Borgatti, Everett and Freeman 2002). To complete the MDS, each pile-sorted term is oriented with all other terms in a proximity matrix, which provides a Pearson correlation coefficient value that defines the magnitude of association for each relationship based on the aggregate responses of all participants. The values produced in the proximity matrix are used to spatially organize the terms in an arrangement which best approximates the "distance" between each term identified in the proximity matrix (Borgatti 1999). This results in a two dimensional representation, rather than a twenty-three dimensional arrangement which would more accurately reflect the precise relationships between all twenty-two terms, that easily comprehesible. Each dataset is given a "stress" value that indicates the strength of validity of the MDS result for the dataset (Borgatti 1999; Borgatti, Everett and Freeman 2002; Bernard

2006). This type of analysis can be considered "causal modeling" and in this case, we hypothesize that the visual representation of data (MDS plot) is a model for the group's cognitive association between all terms (Bernard 2006, 649). The analyst's interpretation of cultural domain data is key in order to identify clusters of associations (or "clumps") and thematic associations for dimensional relationships (or "arrays") (Bernard 2006, 688-689). This quantitative analysis of qualitative data helps to organize and show relationships between the data that an ethnographically embedded researcher may have insight with which to interpret. Together, the cultural domain analysis allows for more in-depth understanding of the vulnerabilities and resiliencies related to climate change for the Deal Island Peninsula area. Results of this activity will be discussed further in Chapter 10.

These various techniques: multi-sited ethnography, participant-observation, semi-structured interviewing and text analysis, structured interviewing, and cultural domain analysis provide a wealth of data on the Deal Island Peninsula area and climate change. These methods provide a useful and broad-based understanding of the Deal Island Peninsula area and DIMCP stakeholder network through the framework of multi-sited ethnography as well as more specific and detailed insights that will be discussed in subsequent chapters. Of particular interest are the vulnerabilities and resiliencies to climate change that Deal Island Peninsula area residents and DIMCP stakeholders identify for the area. The next chapter explores this data with discussion of vulnerability for the Deal Island Peninsula area.

Chapter 7: Local Ethnographic Insight on Vulnerability

Deal Island Peninsula area residents have well-developed ideas about how they are vulnerable to threats such as sea level rise, increased storms, flooding, and erosion, even if there is some uncertainty about the magnitude and timing of particular threats. Understanding how local community members perceive vulnerability to climate change is key to developing successful adaptation plans. Adaptation planning is often based on scientific predictions and information regarding climate change impacts. However, local knowledge and understanding of vulnerability may highlight different concerns or perceive them in significantly different ways. Therefore, I hope to combine analysis of community level vulnerabilities (the topic of this chapter) with other views of vulnerability and threat to create a more robust view of climate change realities later in the dissertation. This knowledge can enhance not only my academic perspective but also the perspective of everyone involved in adaptation planning to ensure plans appropriately address vulnerabilities and are relevant to local communities. Using an ethnographic lens to prioritize local views, this chapter presents data on key areas of vulnerability for Deal Island Peninsula area residents. Before exploring these vulnerabilities further, I will review theory and methods relevant to this approach to vulnerability.

Toward a Working Definition of Vulnerability

Vulnerability is an important attribute of individuals and communities facing climate change impacts. It is a common term, but not easily defined. Ecosystem stewardship researchers position vulnerability as the "degree to which a system is likely to experience harm owing to exposure and sensitivity to a specified hazard or

stress and its adaptive capacity to respond to that stress" (Chapin et al. 2010, 241). This robust definition includes three important components: the hazard/stress itself (such as sea level rise), the exposure/sensitivity to the hazard (how much sea level rise will impact a community), as well as the adaptive capacity to respond (how individuals will accommodate that sea level rise). In highlighting these three components this definition blends ecological and social considerations across the social-ecological system. But, this definition of vulnerability is developed around the analyst's perspective and is based on the ability to quantify and measure system properties and establish metrics to delineate comparative values for vulnerability. Vulnerability is indeed an existing state that can be measured with quantitative analysis, and also a state of perceived future reality that can be anticipated.

We must acknowledge that vulnerability plays a more dynamic role than is suggested through the description above. Chapin et al.'s definition positions vulnerability as a passively created state due to the interaction of other forces. However, vulnerability also interacts and influences outcomes. In their critique of the IPCC's 2007 definition of vulnerability, Kelman and Gaillard (2010) discuss D'Ecole's 1998 "approaches" to vulnerability, which is defined as a "state" of "fragility" a "consequence" (of impacts), and also a "cause: factors leading to disaster" (23). The addition of vulnerability within the relationship of cause and effect is important. Vulnerability then becomes three things: a state of being, a consequence of impacts, and a cause of impacts. This broadening of the vulnerability concept changes its positioning and highlights multiple ways that vulnerability can be reconceived as an active agent. This requires critical awareness to understand how

people view vulnerability, as a state, a consequence, or a cause in different ways. What is defined as vulnerability can change with the position of an individual, as one could interpret or experience vulnerability and resilience in the same situation (Kelman, Gaillard, and Mercer 2015).

These definitions complicate vulnerability and break apart the linearity of space and time to position it as relational within past, present, and future. For this reason, I prefer Anthony Oliver-Smith's (2009) definition of vulnerability: "Vulnerability and risk refer to the relationships between people and the environment including the physical setting and the sociopolitical structures that frame the conditions in which people live" (15). By stressing the dynamic and dialectical nature of vulnerability in a relationship of humans and the environment, Oliver-Smith enables focus on the same variables emphasized by Chapin et al. 2010, but approaches them in a much broader manner. He highlights a place for the social and cultural characteristics of people, which influence the way impacts from a natural hazard are experienced by individuals and communities. Instead of positioning vulnerability as susceptibilities to hazard, he emphasizes the myriad possible conditions that influence the way a hazard will be received. This view of vulnerability is people-oriented but does not by itself provide a sufficient definition of vulnerability.

For the purposes of this dissertation, vulnerability can be defined as a property of a social-ecological system, system sub-components, or individuals arising in response to stress or hazard. But, vulnerability is also an experienced state of being as well as a concept that is understood and perceived by human constituents of the

system. People may understand vulnerability to be a consequence or cause of something, rather than a future or present state. In these ways vulnerability is the product of the relationship between human societies and the environment (Oliver-Smith 2009). While I think it is important to understand how vulnerability is created, my focus in this chapter is to delineate what DIMCP stakeholders know and understand about vulnerability for the Deal Island Peninsula area. What residents understand, experience, and communicate regarding vulnerability will provide a unique and ethnographically rich perspective of how they are and expect to be affected by climate change.

Data on Vulnerability

Vulnerability data derive from multiple methodologies across the DIMCP as detailed in Chapter 6. Local resident vulnerability information is presented here and nonlocal perspectives are presented in Chapter 9. Semi-structured interviews with DIMCP stakeholders are the primary source of vulnerability information. In total, forty-one vulnerabilities were identified for the Deal Island Peninsula area through text analysis and coding of interview data and are included in list form as Appendix D. These items represent the full breadth of vulnerability identified for the Deal Island Peninsula area and were collected in response to the question: "What are the social or ecological features that make the Peninsula vulnerable to climate change?" Information related to the prioritization or frequency of reported vulnerabilities is not given. Instead, Appendix D should be seen as a comprehensive reporting of vulnerability across the Deal Island Peninsula area social-ecological system in 2014. To better enable discussion of the forty-one vulnerabilities during DIMCP activities

with stakeholders, I condensed the vulnerabilities into twelve groupings of similar items. This list is provided in Appendix F for reference.

Once initial coding and analysis of interview data on vulnerability was complete, I extracted information given by local residents as a focus for this chapter. Based on quotes and information from the semi-structured interviews I have developed this chapter to discuss eight key vulnerabilities identified by local residents. Each vulnerability item clearly communicates local community member's understanding of a specific threat or susceptibility relevant to climate change impacts. As much as possible I have tried to rely upon the thoughts and words of local residents alone in describing these vulnerabilities. However, in a few instances I have brought in some additional information to better contextualize the particular issue.

Vulnerability: A Local Perspective

When residents of the Deal Island Peninsula responded to the question about what makes them vulnerable to impacts from climate change, there were eight key categories mentioned. These include: the area being low-lying, sea level rise, land sinking, water table rising, erosion, the disappearance of rich fisheries, as well as changes in weather and community composition. Some categories may incorporate one or more items from the overall list of forty-one vulnerabilities. Responses came from long-time residents as well as part-time residents and come-heres. Answers to this question were relatively short and people did not feel the need to explain what they meant. Overall, residents gave the impression that these vulnerabilities should be self-evident. Yet the particular vulnerabilities they identified are somewhat different than those defined by the full DIMCP stakeholder network (I will return to this point

in Chapter 9). My aim is to provide enough information so that those unfamiliar with the area can better understand the meaning attributed to each of the vulnerabilities by local residents. It is important to note that I do not assume agreement on all of these vulnerability items for all local residents, nor do I assume that the meaning attributed to each item is the same for all members of the local community. But in presenting this "local view" of climate change vulnerability I am attempting to better understand the local perspective as opposed to a regional or scientific and top-down perspective of vulnerability to climate change.

Low-lying

The low-lying nature of the Deal Island Peninsula area is something that local residents take for granted. In response to the question about vulnerability, one resident simply said: "It's low. It's low-lying" (DIMCP Interviews 2014). She was not trying to be curt, but rather found this attribute of the area unnecessary to explain. The Deal Island Peninsula area is surrounded by tidal waters of the Chesapeake Bay and water is a common sight among the communities. In most areas, ditches alongside roads are not wet only during rainstorms but have standing water almost all of the time—and that water fluctuates predictably with the tides. Flooding is a common occurrence during the highest tides, particularly when these tides coincide with bad storms or when storms push or hold the water against coastlines (DIMCP Stakeholder workshops 2014-2015). Figure 8 represents a common sight: water in the yards of homes in St. Stephens (just east of Dames Quarter) after some heavy rainfall. Parts of the main road from Princess Anne out to Wenona are often covered with

flood waters even during small flooding events, despite being raised up to several feet in places where it traverses low-lying areas of the Deal Island Peninsula.

Figure 8: Photo of St. Stephens, MD after a heavy rainstorm

Credit: Chesapeake Bay National Estuarine Research Reserve Maryland

During Hurricanes or strong storms there can be as much as several feet of water over the road in places (DIMCP Interviews 2014). Long-time community members know where and when to expect flooding, and also where areas of higher ground are that provide zones of protection during storms (DIMCP Interviews 2014, DIMCP Community Conversation on Flooding, August 2014). Fortunately, many homes in the Deal Island Peninsula area sit on relatively high ground. One resident discussed the community's experience during Hurricane Sandy (August 2011) this way:

> Up here, unlike Crisfield—Crisfield, like, the whole one part of town was underwater. Up here it would be depending on your elevation, and that could be from house to house, depending on you know, it's just different the way the land is here. So, one house might get flooded, and another one might not be flooded for, you know, a mile away. (DIMCP Interviews 2014)

While there was fairly severe flooding in the Deal Island Peninsula area, it was nothing like that experienced in nearby Crisfield, MD in August of 2011. Slight shifts in elevation across the Deal Island Peninsula area means current threats from moderate storms, high tides, and sea level rise affect the area very differently: some areas are fine while others are flooded. In the future, the low-lying nature of the area means that many more areas will be negatively impacted.

Sea Level Rise

Because of the low-lying nature of their communities, many Deal Island Peninsula area residents believe that sea level rise places their communities in great danger in the next fifty to one hundred years. In response to my question about the future of the Deal Island Peninsula area, one resident said:

> Well, if we're in the cyclical cycle that we're in, you know, obviously we're moving back into sea levels rising, whether—I mean, whether it be man-made or not. I mean, I think we're in that cycle where, you know, sea level is rising. And so, obviously, you know, it's going to affect low-lying areas like Deal Island. (DIMCP Interviews 2014)

His response indicates a great concern for the effects of sea level rise despite the fact that he may not believe it to be anthropogenically caused. There is variability within the community regarding belief in climate change, but almost everyone is interested in the environmental change they witness and can see will be routine for the future. Many older residents including some DIMCP stakeholders are concerned about the potential impact of sea level rise, despite the fact that they themselves are unlikely to be around to experience its effects (DIMCP Interviews 2014). For other residents, this may translate to ambivalence. At our first DIMCP stakeholder workshop, one well respected community member stood up to make several important points related to sea level rise and the local communities. He indicated that local community members

are unlikely to do anything about a distant and uncertain reality, but that when time and experience showed them they needed to make changes, that they would. He indicated that it would be helpful to know when they would have to move away (DIMCP workshop April 2013). But of course, this is particularly difficult to know and many local residents do not have a clear idea of the impact sea level rise will have on their area. While this is an area of great uncertainty there are also other factors which moderate and prevent this particular vulnerability from being considered a current crisis by local residents. Part of it is ambivalence or denial about climate change projections, but it also has to do with features of community resilience that will be discussed in Chapter 8.

Land Sinking

Deal Island Peninsula area residents will tell you that sinking land is very noticeable in certain places. They comment on vast differences in the way the landscape looks today from the way that it did in the past. For example:

> I mean, most of the land down here was farmland. And the marsh has been cut up so bad, it's basically—if you get above Dames Quarter, it's 50 percent water now and it used to be that was all dry land. Now, Dames Quarter, my community, basically looks like a jungle. It's grew all up. Anybody moves down there anymore, they cut the—there's no farm land no more, unless somebody has a back plot, you know, where they grow their own vegetables. (DIMCP Interviews 2014)

Another Deal Island Peninsula area resident reported that between the 1940's and 1960's the marsh was harvested with a tractor for hay (DIMCP workshop April 2013). He indicated that the hay was used during WWII to pack munitions, and later used for mulch and as an agent to dry and clear runways. Nowadays, a tractor or any sort of vehicle would sink into the marsh mud because it is much wetter—even the scientific researchers in waders sometimes get stuck out in the marsh (DIMCP

Community Conversation September 2014). Long-time residents are very aware of a transition from farmland or grazing land to marsh, and from marsh to open water. One resident identified land sinking to be the most worrisome aspect of environmental change for the future:

> I don't know if it's [climate change] threatening right now. It's just worrying about the land sinking. And the land sinking down here is what I consider at a rapid rate right now. And it's—the land is eroding and it's sinking faster, probably in the last 15 years than it has been in the 60 years I'm alive. It's very noticeable. I don't think it's noticeable to the people that move in the area, because they think this is natural. (DIMCP Interviews 2014)

As this resident indicates, land sinking is changing the whole face of the community, and people who are more newly associated with the area would not recognize this pace of change. The sinking of the land means that flooding occurs more often and at a more sustained pace, converting some land to marsh, and some marshland to open water.

A confounding factor for the marsh areas is anthropogenic alteration of marshlands in the 20th century. In the 1930's the marshes were ditched by the Civilian Conservation Corp to drain them in order to lessen mosquito populations and possibly to provide more areas for agriculture and grazing (DIMCP Interviews 2014, DIMCP Workshop April 2013). Likewise, in the 1960's open marsh water management (OMWM) sought to lessen mosquito populations (via fish eating larvae) and provide wildlife habitat by creating open bodies of water (DIMCP Workshop April 2013). The impact of OMWM, however, is contested. This DIMCP stakeholder (a scientist and not a local resident) explained it this way:

> OMWM is less clear. I mean there's a lot OMWM out there. It's a little bit of a political issue, because OMWM is not supposed to be a negative factor towards resilience. There's just so much of it. I mean, look at an aerial photo. […] The idea is that's not going to hurt the long-term resilience of

> the marsh. But it's just so concentrated out there. When you look at an aerial photo, particularly of certain areas, it just doesn't seem like having so much of the water in a marsh is really healthy. You know, eventually, that could cause—as sea level rises, that threshold of collapse could be a lot sooner because of the OMWM. (DIMCP Interviews 2014)

Many local residents, however, are clear in their understanding that MD-DNR's management is responsible for the environmental degradation and vulnerability introduced to the marshlands:

> Yeah, the clubs [early 20th century hunting clubs that owned the marsh prior to MD-DNR] managed them very well. And since the State got them, they've dug them up and dug ditches and stuff. And it's sinking. Sometimes I think if you just leave well enough alone down here, I think it works out. Mother Nature knows best, I think. (DIMCP Interviews 2014)

As locals understand it, this mismanagement of the marshes is one reason among several that many local people distrust MD-DNR and what they see as other forms of governmental interference. Land sinking is an important issue for people in the Deal Island Peninsula area because they recognize marshes are the lowest-lying and first to be affected by overall change. This issue will be discussed further from a non-local perspective in subsequent chapters.

Rising Water Table

A rising water table means that the average level of ground water is increasing. The rising water table was not something that was talked about often by Deal Island Peninsula residents, however it is important to mention because of its confounding interaction with other vulnerabilities. In the following dialog between two local residents you can see the ways in which knowledge about vulnerability is contested and built upon. In this case, the residents debated whether land sinking or rising water is a bigger issue:

R1: I had an interview… it's been about two or three years ago. And they were—what they were just discussing was how everything was sinking around here, how the level of the land was dropping.
R2: Water table ain't rising?
R1: Water table's rising up, you can see it under this building.
R2: I'm saying, they said it's not sinking, it's rising. The water level is rising.
R2: And has usually, normally, it's –let's see, a foot every 100 years. And in the last 15 years it's up an inch and-a-half. So it's an inch over 10 years now.
R1: I believe you can see that above Dames Quarter, all that's water now.
R2: But as soon as the polar cap freezes again, we'll be fine.

This conversation begins with the second resident questioning the reasoning of the first resident, and supplying an additional or alternate explanation. When the second resident adds more information about the rate of increase, the first resident readily goes along with the explanation and cites a physical example in Dames Quarter to support the argument, though he does not say sinking land is not a factor. The brief conversation is ended quickly with a joke meant to break any tension. This conversation is interesting because it clearly indicates that local residents are not quite in agreement on the causes of some of the changes that they are seeing. The second resident actually happened to arrive during an interview I was holding with the first resident and had interjected himself into our conversation. It is possible that the second resident wanted to problematize the view that land sinking was responsible for all the change to provide a reminder about the complexity of the situation for the Deal Island Peninsula area. Some residents are aware that the water table is rising, but the magnitude of this threat seems to be unknown to them. However, it may become an even more relevant factor in the future due to implications for sewage, drinking water, salt-water intrusion, and flooding for local residents.

Erosion

Deal Island Peninsula area residents recognize there is high risk living in low-lying areas and readily acknowledge instances of other island communities across the

Chesapeake Bay that no longer exist due to erosion, such as Holland's Island. Actually, there are several homes from Holland's Island that were moved to the Deal Island Peninsula area when the island became uninhabitable due to erosion (DIMCP Workshop April 2013). Many wonder if that will be the eventual fate of the Deal Island Peninsula area, but they also know that erosion and other factors of environmental change are normal for the area. For example, high tides are something people are accustomed to. As expressed by one resident: "We're used to high tides. When it floods, we have to take the boat to church." (DIMCP Interviews 2014) For most people outside of this community, a flooded house would probably preclude them from their normal routine and instead constitute and emergency situation, but this situation is somewhat normal for residents of the Deal Island Peninsula area. Residents also recognize severe storms as events that can drastically alter shorelines in coastal areas. Older locals recall accounts of storms that drastically impacted the area such as an August hurricane in 1933 that destroyed homes, the area's hotel, the steamboat wharf, and a small peninsula off of Deal Island, MD (DIMCP Workshop April 2013; also see account in Fincham 2010). While area residents have come to expect change, many stakeholders indicated that they are seeing erosion happen at a much faster pace, and noticing tides higher than ever with storms (DIMCP Interviews 2014).

The erosion occurring now, especially for the Tangier Sound portion of the shoreline, is quite dramatic. One resident in Dames Quarter reported that in front of their home the shoreline has eroded at least thirty feet within the past thirty years, bringing the Tangier Sound much closer than they ever imagined. On Deal Island a

dune area with thirty-foot dunes used to be about one hundred and fifty feet inland from the beach on the Tangier Sound side of the Island. In the middle of the 20th century the beach, dunes, and a forest in between served as recreational space for the children of the area (DIMCP Landscape Change Interviews January 2015). Over the course of the past 40 years however, this shoreline has eroded and the dunes are almost completely gone. Changes such as this—occurring as a matter of course rather than due to a large storm event—are disconcerting to the local residents and make them very worried about the future.

For other residents who do not live along the shorelines, erosion and incremental changes may be less evident. One resident explained that the high tide or moon tide (highest high tide) is a normal occurrence for area residents that normalizes high waters so that unusually high waters at other times do not yet seem concerning—despite the effect higher waters can have on erosion of shorelines and ditched areas (DIMCP Interviews 2014). Another Deal Island Peninsula area resident described this idea in a slightly different way, as having "perspective" on climate change:

> You can come down on any given day and you look out [across the shoreline] and you say—they're talking about the sea level rises on a low tide after a windy day like today and you say ain't no way! And then you come down at the end of a hurricane and say, wow. So it's all about perspective. I believe that's the key to climate change. (DIMCP Interviews 2014)

It is clear that the perspective of some Deal Island Peninsula area residents about erosion is much more extreme than others. Indeed, it is difficult to differentiate "natural" change from that due to climate change and other associated forces. Either way, certain shorelines, particularly along the Tangier Sound, are being greatly

affected. In other places, too, the shoreline erosion and interior erosion of marshlands is becoming more noticeable.

Disappearance of Rich Fisheries

Although early colonial residents partially subsisted on harvesting the Chesapeake's waters, it was not until the middle 19th century that seafood harvesting became a lucrative industry, and the area began to experience population growth (DIMCP Interviews 2014). Due to the limited land area, a local historian argues that farming alone could not have supported the area's relative high population densities in the late 19th century (e.g., one thousand people in Deal Island, MD in 1880) had it not been for the expanding fishing industries (DIMCP Interviews 2014). In the early twentieth century Deal Island and nearby Crisfield, MD were reported to be the premier soft shell crab producers along the Atlantic seaboard (Lefferts 1918, 40). By this time, Crisfield was Maryland's second largest city (after Baltimore) due to seafood processing and shipping (DIMCP Workshop April 2013). Oysters (*Crassostrea virginica*) were the most important economic resource through the early and mid 20th century until their decline caused a shift to the blue crab (*Callincectus sapidus*) harvesting (Ernst 2003). Reliance on the seafood industry is part of the Deal Island Peninsula area's heritage, and a historic mainstay of the culture, as discussed by a DIMCP stakeholder:

> 'Watermen' is a unique term to here on the Chesapeake Bay. It came from England, meaning a person who did activities on the water, but they weren't just a crabber, they weren't just a fisherman, or they weren't just an oysterman, they were watermen. And that term came from England to the Chesapeake Bay where we do all the activities to survive—crabs during the summer, oysters during the winter, fish are in between. And those—that's what makes the Chesapeake Bay a different animal in itself. Watermen are of the Chesapeake Bay. If you go to Alaska, you've got the crabbers who are King crabbers. And then you've got the fishermen who are fishermen.

> They're not called watermen anywhere else in the United States but here on the Chesapeake Bay. (DIMCP Interviews 2014)

Over the years, the sustainability of the fisheries has declined and catching oysters, fish, and hard and soft crabs (same species) has become a much more difficult way to make a living and support a family. One stakeholder said that other than the aging of the community, the other thing making the community vulnerable was that "the rich fishery that was there at one point is really not there [anymore]" (DIMCP Interviews 2014). Today, a much smaller percentage of men in the community maintain a living as working watermen. This stakeholder indicated that probably no more than sixty men in all of the communities (Dames Quarter, Chance, Deal Island and Wenona) still earn a living this way:

> [Watermen working on the bay are] a lot less than it used to be. It used to be hundreds in this area and now it's probably—probably in these four communities I would want to say no more than 60 of all—of all groups in these four communities. There's only 4,000 licenses [to work the water] on the whole Chesapeake Bay. (DIMCP Interviews 2014)

While people in the Deal Island Peninsula area are interested in maintaining their historic way of life, many young people (and watermen themselves) realize that being a waterman is hard work with variable (and no guaranteed) pay. As the economic opportunities in seafood harvesting have been dwindling over the past century, younger adults commute or move out of the area to seek better incomes in larger towns nearby or to Baltimore, Washington D.C., or Philadelphia. In fact, a number of individuals most active in the area's heritage organization, Skipjack Heritage, Inc. (http://www.skipjacklore.org), were born in the area but moved away for jobs, have now retired, and are working to promote the history and heritage of the area (DIMCP Heritage Research Project Meeting 2014).

The decline in fisheries is a complex process caused by a number of interacting factors such as the fecundity of the catch populations, competition from other watermen, disease, hypoxia and eutrophication, population disturbance, and pollution and use of the Chesapeake Bay (Kemp et al. 2005). But, perhaps most importantly to local area residents are the limits that regulations have placed on them. Although catch limits and other regulations are in place to protect the species that watermen catch, many watermen feel that regulations and license fees unfairly burden them with responsibility in a situation caused by larger problems. One resident communicated the burden this way: "When they changed laws, [and the] little fellow couldn't prosper. They pushed the poor man, the common man, out." (DIMCP Interviews 2014). Watermen operate independently and it is very difficult for them to shoulder the burden of licenses, insurance, equipment upkeep, regulatory constraints, etc. on their own while remaining competitive with cheap seafood imported from abroad (see Paolisso 2007). These changes affect not only individual watermen and their families but have contributed to changes across the communities of the Deal Island Peninsula area.

Changes in Weather

One worry for Deal Island Peninsula residents is changes in weather patterns and extreme weather due to climate change effects. One resident said he feels that rain and thunderstorms have decreased locally—with the storms and rain moving to the Chesapeake's western shore instead (DIMCP Interviews 2014). Other residents are concerned about how changes to weather patterns may impact their livelihood activities. One watermen described the problem this way:

> Because in order to work here and fish here and to be here, you have to have access to the water and you have to have access to the Bay. On any given day, if it's too windy, because of climate change, you can't get out there and have access to it—and then if it's too cold, it freezes up and if it's too hot, it's to hot to actually work. (DIMCP Interviews 2014)

Climate change becomes real and tangible for people through extremes in weather. Weather is what people talk about on a day-to-day basis, unlike climate variability (DIMCP Interviews 2014). It therefore functions as a way to connect to the environment on a personal and experiential level. But, the weather is also seen as something the media dramatizes, as part of an outside discourse that is removed from real life (DIMCP Interviews 2014). Similar to hype about the weather, the outside discourse on climate change is one that locals have struggled with. In this quote, a resident discusses his change of heart regarding climate change:

> Truthfully, I was—just about several years back I [didn't believe in climate change]. And now, yeah, I do believe there is such a thing as climate change. There's a lot of changes around here. Some types of wildlife that are here now that were not here then. The land is sinking, it's got to be sinking for a reason. The rivers are getting deeper. The weather is a lot worse than it was. So I'm skeptical, but I do believe the scientists got something going, that they're right. Hope that they're wrong and I'm wrong, but I believe they're right. (DIMCP Interviews 2014)

Changes in weather, particularly the weather "getting worse" is one of a few reasons he cites for his shift in belief on climate change. As with many other communities, Deal Island Peninsula area residents have traditionally understood the larger world through their own local experiences. Changes to routine weather patterns displace this traditional and place-based knowledge leaving residents less secure in their ability to plan for the future. This is also linked to the community's reliance upon tradition and experiential knowledge—their private heritage—to navigate life's challenges (Chambers 2006).

Changes in Community Composition

The social fabric of the community has been altered due to changes in community structure, some of which are mentioned in Chapter 2 and earlier in this chapter. Chief among these are the aging of the community, lack of young people, and the influx of second homeowners and retirees (the come-heres). The primary driving force for these changes in the community is seen to be lack of employment opportunities, as reflected by a local resident: "Once the work faded out, they had to go elsewhere. The younger people aren't going to do the work that the older ones did" (DIMCP Interviews 2014). This is particularly true for the African American community who cite racial barriers to finding skilled employment opportunities nearby. One resident explained her children's experience of this barrier this way:

> That's why we don't have any children here. No work. Can't stay here with no work. They all graduated from high school, went to college, and tried to come back—and they wouldn't hire them! So they went back to where they were. (DIMCP Interviews 2014)

These changes have impacted the ways that people traditionally acted as a safety net for one another. Despite more links to the outside that help to fill in these gaps, long-time community members feel more vulnerable due to lack of cohesion (DIMCP Interviews 2014). Civic organizations such as the Lion's Club and Volunteer Fire Department have almost no younger membership, but these and the churches continue to operate despite dwindling numbers. The feeling that the basic attributes of the community will not continue into the future is a source of sadness for many residents. Many informants suggest that the community used to be much more open, social, and shared in ways that are no longer apparent. Two examples from conversations with

local residents stand out from the interview data. In the first, a resident reflects on the increasing insularity of the community as newcomers move to the area:

> It seems like the people that moved in are not as friendly [as people used to be]. Used to be you could have traveled here to Dames Quarter and never get on the road, if you wanted to travel across somebody's land nobody said anything. We all knew each other. (DIMCP Interviews 2014)

Another stakeholder expressed a similar concern through reflections on the increasing privatization of the area's beaches: "We used to have beaches we could go to. Now everybody has bought the land in front of the beach. They can't own the beach, but now you can't access the beach." (DIMCP Interviews 2014). These reflections communicate a sense of communal space that has changed dramatically in the lifetime of these residents.

Physical characteristics of the Deal Island Peninsula area are also interfacing with the outside world in new ways. Two relatively recent considerations have and will affect the community's composition. First is the availability of medical care. One interviewee told me that often retirees move in, but within ten to fifteen years have moved away again to be closer to medical and emergency facilities which they have greater need for as they age. She indicated that this is a concern for local residents as well, but that many of them would stay for as long as they can in the only place they have ever called home (DIMCP Interviews 2014). As people become more accustomed to medical care, this may change even for long-time locals.

Another concern that has perhaps already begun to alter the composition of the community is insurance costs. For now, this is primarily a factor when initially buying a house. The cost for flood insurance is thought to be especially high and local residents indicated that this would be a large impediment for the younger generations

(DIMCP Workshop April 2013). It may also affect home resale values, and there may come a time when flood insurance premiums are raised exponentially. In the shift away from resource-driven employment and towards stable jobs with benefits, health insurance, and routine health coverage, the ability of local residents to be self-sufficient is greatly diminished. As described in Chapter 2, Deal Island Peninsula area communities used to be far more independent than they are today. The loss of that self-sufficiency means a loss in their traditional culture and relationship with each other and the environment.

Conclusions

These eight vulnerabilities identified by Deal Island Peninsula area residents reveal the ways in which locals understand and perceive the vulnerabilities they face due to climate change. These vulnerabilities are not physical threats, but rather changes that increase the negative impact to their communities. For example, change in community composition is not a threat of climate change but the way that climate change impacts will be felt will be compounded because there are fewer young, more newcomers, less economic stability, and more aging individuals. Local residents see these changes as increasing their susceptibility to outside influence and undermining their traditional self-sufficiency. Changes in the community's composition should be seen as a vulnerability that will increase negative impacts from climate change, but it must also be seen as something that is independent of climate change—an ongoing reality.

The range of vulnerabilities identified by Deal Island Peninsula area residents may make impacts from climate change seem like tipping points that will push a

struggling community past their abilities to cope. However, each of the eight vulnerabilities identified: the area being low-lying, sea level rise, land sinking, rising water table, erosion, disappearance of fisheries, changes in weather, and changes in community composition, are ongoing processes for the Deal Island Peninsula area that local residents are coping with in various ways. Some of the ways in which they are meeting these needs are discussed in Chapter 8 on resilience. These current-day experiences may worsen with additional climate change impacts but we cannot forget that they are already experienced realities.

Some of the vulnerabilities point to changing relationships between local residents and their environment. A particularly good example of this are changes in weather that residents are beginning to notice. Because weather is usually fairly predictable and constant, changes in basic weather patterns like heat and rain seem to undermine the knowledge and long-standing association that long-time residents have had working out on the Tangier Sound or in the Chesapeake Bay. They perceive the world changing around them in new ways that it has not done before. And yet, they also recognize that the environment, economy, and cultural composition of their communities have been in a state of slow change since colonial times.

Community members realize that some change is natural (some erosion, some land sinking, some of the sea level rise) but they see human actions and interactions with the environment as also significantly responsible. Deal Island Peninsula residents see ways that outside influences have made their communities more vulnerable. A primary one is through the environmental degradation affecting area fisheries and spurring policy and regulations limiting watermen's livelihoods.

Another is management of marshlands contributing to marsh degradation, erosion, and land sinking. Though the rising water table was only briefly mentioned, this vulnerability too is caused not by climate change, but by geological processes in addition to human use of groundwater. For local residents, impacts from climate change will not be a simple matter of the global environment affecting their local environment, but a much more complex reality that is dependent upon linkages (both positive and negative) between humans and the environment.

Some of the vulnerabilities identified are seen as being less subject to human control. Local residents accept the low-lying nature of their communities, existing sea level rise, ongoing erosion, and geologically-produced land sinking as realities. They are practical and know humans sometimes must accept the way the world is:

> …it's kind of a 'life goes on' kind of thing, where if you really can't do much about it, you're probably not going to do a whole lot. I'm not going to say you're going to, you know, destroy the environment. (DIMCP Interviews 2014)

This resident summarizes perfectly the perspective that local residents have that sometimes gets misunderstood as a lack of knowledge or acceptance about threats from climate change. People know there are plenty of ways in which they are vulnerable. But things are far from hopeless for the residents of the Deal Island Peninsula area and many important resiliencies that work to oppose vulnerabilities are discussed in Chapter 8.

Vulnerabilities identified from the local resident perspective: their low-lying disposition, sea level rise, land sinking, rising water table, erosion, disappearance of fisheries, changes in weather, and changing community composition give us detailed insight into the ways area residents perceive themselves in relation to climate change.

With further information on local insights into resilience (Chapter 8), nonlocal additions to vulnerability and resilience (Chapter 9), and a summary of the overall DIMCP stakeholder network understandings of vulnerability and resilience (Chapter 10) we will have a much broader and well-informed understanding of what the Deal Island Peninsula area faces with regard to climate change.

Chapter 8: Local Ethnographic Insight on Resilience

This chapter presents information gathered from DIMCP stakeholders on resiliencies to climate change for the Deal Island Peninsula area. Deal Island Peninsula area residents acknowledge particular vulnerabilities due to climate change impacts as discussed in Chapter 7. With a basic knowledge of threats and vulnerabilities faced by area residents, attention can be given to defining the resiliencies inherent in the social-ecological system. Local knowledge of resiliencies can be paired with understanding of vulnerabilities to better inform climate change adaptation planning strategies. Without resilience information, outside adaptation planning strategies may assume a lack of resilience, or worse unintentionally undermine existing resiliencies. Thankfully, the full DIMCP stakeholder network was able to define many resiliencies for the Deal Island Peninsula area. A comprehensive list is included as Appendix E; this chapter's focus is on local views of the resiliencies identified by Deal Island Peninsula area residents. First, I provide a brief review of my perspective on resilience theory and describe key elements of the resilience data collection process.

Understanding Resilience

As defined earlier in Chapter 5, resilience can mean the ability to cope with and weather change and perturbation, and also to be able to plan, adapt, or transform to accommodate change (Walker and Salt 2012; Boyd and Folke 2012). Theory on resilience has been used across the social and ecological sciences and has also been used to develop key insights on ecosystem dynamics and psychological resilience (Brown 2014; Kelman, Gaillard, and Mercer 2015). Critiques of resilience literature

have emphasized there has been too much focus on social institutions in social-ecological systems rather than concentration on issues of power, agency, and the negotiated and processual nature of social interactions (Cote and Nightingale 2012; Davoudi and Porter 2012; Davoudi et al. 2012; Kelman and Gaillard 2010; Weichselgartner and Kelman 2014). My approach is to emphasize these varied definitions and critiques of resilience and focuses on understanding how social-ecological system participants themselves define for resilience to climate change.

Data on Resiliencies

Resiliencies identified by DIMCP stakeholders provide insight into the strengths and adaptive capacities of the Deal Island Peninsula area and social-ecological system. Semi-structured interviews provide the primary source of information, but additional methods are used to help contextualize resiliencies for the Deal Island Peninsula area, as discussed in Chapter 6. Based on interview data and text analysis, thirty-seven resiliencies were identified for the Deal Island Peninsula area (see Appendix E). Using stakeholder's knowledge in response to the question: "What are the most resilient features of the Deal Island Peninsula?", I created a list of resiliencies representing views across the Deal Island Peninsula area. As with the vulnerability data, resiliencies are not prioritized nor do they indicate how common a response the item was among the respondents. Instead, this list of thirty-eight resiliencies should be seen as a comprehensive reporting of resiliencies in 2014 across the social-ecological system. To make it easier to use this data in DIMCP collaborative activities, I condensed the list of thirty-seven resiliencies into eleven groupings. This list is provided as Appendix F. Before proceeding with discussion of

resiliencies identified by area residents, I would like to note that in response to the resilience question, many DIMCP stakeholders identified negative resiliencies, or things that indicated lack of resilience. I do not discuss these here as the majority of items were also covered as vulnerabilities in the previous chapter, but want to mention that resilience is not viewed only as a positive attribute by Deal Island Peninsula area residents. This is an important point to highlight in terms of local's perception and definition of resilience.

Resilience: A Local Perspective

For people living in the Deal Island Peninsula area, resilience means many things. It incorporates the natural environment, human inhabitants and attributes of community-oriented living. Particular resiliencies identified by local Deal Island Peninsula area residents include: marsh and marsh grass, protected shorelines, blue crab fishery, ability to handle flooding and storms, faith and closeness to nature, independence and resourcefulness, social networks and community, and resilience as a state of mind. These resiliencies have to do not only with the long-term success inhabitants have had in living in the area, but it also with cooperation and developing community bonds with newer residents. As with Chapter 7, views from long-time residents as well as newer residents have been included. Each of the resiliencies below contributes to a picture of what the overall resiliencies are for the Deal Island Peninsula area, but perhaps more importantly, what local people see as the resiliencies they may draw upon in addressing future needs.

Marsh and Marsh Grass

The prolific marshes of the Deal Island Peninsula area are seen as resilient by residents, who have had plenty of experience in being surrounded by them. One resident said: "When you neglect land, marsh grasses are resilient—once they start to creep in they really take over" (DIMCP Interviews 2014). Local residents may feel in some instances that the marsh grasses are "taking over" their living spaces, but they also recognize that marshes play a protective role with flooding, storm surge, and erosion (DIMCP Community Conversation September 2014). In addition, among local residents there is a belief that marshes are resilient in adapting to changing environment and conditions. One resident explained his views of the marsh associated with MD-DNR's impoundment this way:

> I would like to know the elevation difference between what's inside that impoundment and what's out on the natural marsh. And I just got a theory, that's all it is, that the elevation is probably higher in some areas inside that impoundment than it is on the outside right now. So the marsh does have resilience, in some areas it will build itself up to match the land around it. (DIMCP Interviews 2014)

Despite the overwhelming number of environmental vulnerabilities that were outlined in the last chapter—especially with regard to land sinking, the marshes of Deal Island Peninsula are for now still seen as being resilient to change and as having some ability to adapt to changing conditions.

Protected shorelines

The historic homes and community resources (churches, schools, cemeteries, etc.) are largely found inland among the Deal Island Peninsula communities. Long-time residents will tell you that this is not by accident, their ancestors deliberately positioned buildings and homes away from the shorelines to protect from storm

damage: “We, as people who are native here, we never built on the water because we knew eventually those storms would come up and get in the houses” (DIMCP Interviews 2014). However, as waterfront property has been sold off to come-heres over the past century many newer houses are built along the shorelines, particularly on the Tangier Sound side of the Peninsula where there are not as many marshes. Since shoreline erosion has been problematic for decades, many people (mostly come-heres who own the waterfront properties) have built barriers along the shoreline to keep the land in place. This practice is now allowed only in areas of high wave action (such as along the Tangier Sound) and current environmental policy favors a more dynamic and adaptable environment such as living shorelines in calmer areas. The people of the Deal Island area see the protection of the shorelines through bulkheading as a benefit. One resident identified the protected shorelines and come-heres who had put them in place as resilient: “Well, the people who put riprap on the shorelines and bulkheads and those kind of things, it’s made a big difference” (DIMCP Interviews 2014). And another said: “...just seems like the only land that’s not receding right now is where people are living along the shoreline because they got it bulk-headed in” (DIMCP Interviews 2014). One local community member felt it unlikely that long-time residents, such as his father, would have spent money to protect the land from erosion. In discussing this reality, he said that although his father would not have done anything to protect the shoreline himself, he is in come ways appreciative that it is:

> I don’t want to say he’s thankful, but, I mean, you know, he’s glad, I’m sure, that someone has stepped up, at their expense, people—you know, to bulkhead it and preserve, you know, the shoreline enough as it is. (DIMCP Interviews 2014)

Depending upon your perspective, resilience regarding protected shorelines can mean not living along the shoreline in the first place, in protecting the shoreline from erosion with bulkheads etc., or, it can be in the people (and their effort and resources) who made the shoreline protection a reality. These varying perspectives and experiences of resilience for shorelines and erosion foreshadow larger questions of "what does resilience mean?" for the larger Deal Island Peninsula area.

Blue Crab Fishery

The communities of the Deal Island Peninsula area have withstood many changes in the fisheries surrounding them. The oyster, blue crab, and rockfish industries have ebbed and flowed with species population dynamics, state regulatory requirements, diseases, harvesting pressures, and economic fluctuations. However, one species in particular continues to be a mainstay for Chesapeake watermen: the blue crab (*Calliencecus sapidus*). Both predators and scavengers, blue crabs are an adaptive and highly abundant species within the Chesapeake Bay that has supported a robust regional fishery for much of the last century, and become an iconic characteristic of the Chesapeake Bay region (Paolisso 2002). They are caught and sold from spring through fall. Some are caught just before molting and are held in tanks until they shed their shells and can be sold as soft shell crabs (Paolisso 2002). The crabbing business often involves other family members, particularly in the extra care and handling required for soft shell crabs. Marshes provide habitat for juvenile crabs, so the Deal Island Peninsula area of the Tangier Sound has always been a good place to catch them (DIMCP Interviews 2014). One of our DIMCP stakeholders described the crab's resilience this way:

> I think crabs and crabbing are quite resilient. And, you know, I say that because they're a short-lived species that responds immediately to regulatory intervention and to changes in the condition of their environment, and that properly managed by the community […] crabs and crabbing can be hugely resilient. (DIMCP Interviews 2014)

In addition, climate change is predicted to have positive impacts for crabs, oysters, and some fish, particularly through warmer weather and longer growing seasons (Najjar et al. 2010) [5]. Local residents are somewhat aware of this prediction. One part-time local resident said: "I was just was talking with a marine scientist that studies fisheries and he said, yeah, pretty soon—he said before the century is over, we can harvest crabs year round because of projected climate change" (DIMCP Interviews 2014). The key to the continued resilience of the blue crab fishery is managing harvests and maintaining spawning areas so that populations can continue to prosper. Additional and improved policies are also need to support watermen to produce and market their products, most specifically, to protect against imported crab meat (Paolisso 2007). Crabs play an important economic and ecological role in the Chesapeake Bay and their maintenance into the future can help local residents weather climate change impacts.

Ability to Handle Flooding and Storms

Local community members are accustomed to low tidal flooding and flooding associated with minor to moderate storms. A part-time resident describes it this way:

> …there's a lot of internal community capacity to handle flooding, to a certain level. And storms. Because there's strong social networks out there, that if you need help and you get flooded out, the churches, the Lions Club—so there's a great capacity out there, more-so than in urban areas, to

[5] There are also negative impacts predicted as well due to increased spread of disease and parasites, greater threats from predators, and other changes in Bay water and species composition (Najjar et al. 2010).

> handle the impacts of climate change up to a certain level. (DIMCP Interviews 2014)

In times of low to moderate flooding and somewhat severe storms, people often remain in their homes. With stronger storms people tend to stay more inland with extended family or friends. An emergency responder told me he estimates that only about 30% of people remained in the area during Hurricane Sandy in 2011 (DIMCP Interviews 2014).

Hurricane Sandy provides an excellent example of the community's ability to handle flooding and storms. Sandy inundated Crisfield, MD (just to the south) which received significant government assistance and media coverage. However, people in the Deal Island Peninsula area did not talk much about Sandy, so it seemed they had been far less affected. I found out later that damage was actually fairly severe with fallen trees and flooding in the low-lying and shoreline areas. Water was so high in places that an emergency responder describes waves lapping the sides of his pick up truck and reaching the bumper on the fire department vehicles. He remarked at the quickness of the rising waters: "When Sandy came here, she come such a—nobody had seen that much tide rise before that quick. And I know—I was out in it!" (DIMCP Interviews 2014). When the volunteer fire department began getting calls from people wanting assistance evacuating their homes, they were able to use big fire trucks to extricate a few people. But as waters rose higher they could only tell others to remain where they were. Fortunately, and just in time, the tide began to recede:

> Been another hour's tide rise, I wouldn't want to see what's going to happen around here. It would have been really bad. […] never in my 60 years, never seen tide rise that fast. Scary. (DIMCP Interviews 2014)

Hurricane Sandy shows us that people in the Deal Island Peninsula area did what they could, or left ahead of time and came home later to pick up the pieces. Sandy was much worse for this area of the mid-Atlantic than projected, and could have been even worse if the tides had been different. Yet, emergency response was handled locally without immediate support from the County or State. And in fact, the Deal Island Peninsula area sent emergency responders and aid to Crisfield and another nearby community that was hard-hit. People were able to take care of themselves and each other within the community through this surprisingly bad storm. No one denies the need to continually improve preparation for such events, but experience and knowledge passed down through generations has helped to develop resilience to withstand such difficulties.

Faith and Closeness to Nature

Living in a coastal environment means coping with and participating in a dynamic relationship with the natural environment. One local resident, in responding to a question about how he would describe the area to an outsider, mentioned this relationship as a "closeness and oneness with nature":

> [It has] a rural atmosphere, with a family closeness that runs beyond family names. As a family unit living and experiencing with nature, because we're close to nature. Learning how to not only survive, but also to thrive on any given day, to make things better. So I would describe it as a rural setting, where family runs more than just the dynamics of a small group, but as a community, and giving us the ability to be closeness and oneness with nature in a way of not only surviving, but thriving. I would think that would be how I would put it. (DIMCP Interviews 2014)

Fluctuation and change in the environment, through weather, tides, floods, storms, and erosion are normal. Deal Island Peninsula area residents feel a responsibility to live within and provide stewardship for the environment:

> And I think the resilience of it is as a peninsula and as a people, that and then the land itself, the Chesapeake always takes some and it gives some—for every piece of land that's eroded somewhere there comes another piece somewhere that builds up. It's up to us to keep it—to keep within the high land. (DIMCP Interviews 2014)

In saying the Bay "takes and gives" this individual is positing both that the natural environment has a balance and steadiness to it, but also that the world is dynamic and partially incomprehensible to humans. The changing nature of the environment is something to endure, to adapt to, but also something to be in awe of and to try to respect and admire. The value of the environment as an ever-present force shaping the world cannot be understated. This local stakeholder described its constancy this way:

> I would have to say that nature itself is the most valuable asset we have. The people come and go. Houses come and go. Even with erosion, property comes and goes. But the one—the one steady factor is the beauty and marvel of nature in its—some of its original state. And I believe that's the most beneficial thing we have to offer. Nothing is more beautiful than seeing an eagle fly down the shore and get a fish out of the water. And people say, oh, that's awful, that fish didn't deserve to die. [But it's beautiful]—because that's constant. It's constant through every generation, through every century. It's been strong people here from the beginning with the Indians, to the settlers, to us today. And after we're gone, if there's still land here, they'll still be coming for that reason, not necessarily about having a private, quiet spot, but to be as close to the beauty that God has created as you can possibly get without being a part of it, you know. I can't be a fish, I can't be a bird, but as a human being I can get as close—this is as close as I can get to it. (DIMCP Interviews 2014)

This quote touchingly describes the way in which local community members can see themselves as being tied to, dependent upon, and yet also subject to the natural forces that surround them in God's world. People have faith in God that they will be able to handle difficulties in life, whether storms, flooding, or the changing community and economic world around them. One resident understands faith to be adaptive this way:

> …many of them are people of faith and that faith is really adaptive. It's incredibly adaptive, even if they have to leave and—I mean, so how do you define adaptive and how do you define vulnerable? For example, [a local resident] he's not worried about climate change. It may be happening and if he had to move it would be hard for him, I mean, it would just be

> devastating. But his faith that this was part of a plan would help him quite a bit. (DIMCP Interviews 2014)

Because of their faith in God, potential threats such as erosion, sea level rise, flooding, and increased storms are recognized, but not seen as crises. Precariousness is seen as a natural state of affairs that can be overcome through hard work, sharing experiences, skills built up through generations, and faith in God's plan. This is a key to their adaptive capacity.

Independence and Resourcefulness

Local community members see their vulnerabilities as surmountable and take pride in their abilities to provide for their families and meet the challenges life gives them. This is a historic tradition that has served them well through the generations. One resident who can trace his family back to colonial times said:

> Well, I would say [the area is] resilient because it's been here since the beginning of the country. [There have] been people who have survived and lived along these shorelines since some of the early settlers around the Chesapeake Bay. And why are [there] still people here? It isn't because of the convenience of it. It isn't because of the money that's being made here, it's not no Wall Street money being made here. […] The resilience of it is that it's a lifestyle that's fulfilling, that's enjoyable for those who enjoy being close to nature and close to older things, to things set aside to quietness. (DIMCP Interviews 2014)

To survive in such an environment, to continue thriving even when life isn't convenient and it is not easy to make money, takes some skill and tenacity. One come-here describes the capabilities of local residents this way:

> I mean, like, historically the people that moved out there from the 1600s onwards, these were tough people. And so these people know how to work and they know how to survive and they can take a hit hard. I mean, and they're kind of proud of it, you know. People say I raised my children without, you know, medical insurance because […] we didn't have it. And there was a sense of pride. I didn't take my kids to the doctor, because I didn't, you know, I didn't want to be in debt to anybody. And they're resourceful. I mean, people out there are multi-capable. You know, men

> can do—they can fix things, they can build things, they can—you know, they can make a living on very, very little. (DIMCP Interviews 2014)

Independence and resourcefulness among long-time locals is a source of pride and one reason that local residents tend to be capable and self-reliant. The people of the Deal Island Peninsula area are used to their rural isolation and differentiate themselves from "city people." Many locals see this insularity as a benefit. One resident put it this way:

> ...the most resilient is the people down here, they just—we tend to make out good being by ourselves. I mean, we don't—we don't need no—seems like this area doesn't need a lot of help from up the road, as long as we keep our roads maintained and stuff like that. But we do fine by our-self. Not that we want to close our-self from the rest of the world, but . . . I've heard people come down here and they say it's a wonder we've made it for so long. But I think the people down here can live fine by their selves, I mean, we basically earn and make our own living, we're our own bosses. We tend to have more of an independent way of living that I don't think the rest of the world understands. (DIMCP Interviews 2014)

People learn skills and knowledge from the older generation, and quickly gain proficiency with multiple types of work. The range of experiences that many Deal Island Peninsula area residents have provide a tremendous base for the impacts projected from climate change. This is perhaps why one resident, in responding to what makes the area resilient, simply said: "It's people. They've lived this" (DIMCP Interviews 2014). This lived experience is something that we tend to discount when thinking about climate change because of the magnitude and newness of the threat. For people here, though, climate change simply intensifies many of the challenges they have been dealing with for generations.

Social Networks and Community

The Deal Island Peninsula area has a well-developed social network and sense of community. Long-time locals and newcomers exist side-by-side within a rural and

bucolic setting. In an interview with a Deal Island Peninsula area resident, he explained the differences among several types of people but emphasized their interdependence in creating a community atmosphere. There are the long-time locals who make a decent living and are supported on a mix of traditional livelihood activities and out-of-community employment; there are also those people who are just making ends meet (both long-time locals and people who have moved in); and then there are the more well-to-do retirees and second home owners. Key features of the area that allow this dynamic interrelationship between long-time locals and outsiders are affordable home prices, relatively low cost of living, and a shared desire for nature and peace and quiet (DIMCP Interviews 2014). One local resident described the pull of the Deal Island Peninsula area this way:

> It has the close proximity to be able to do the enjoyable activities of the water. Also, the isolation of noise and busy activity is less here. So it gives us—people who don't like quiet and don't like slower pace of activity can't do well here. (DIMCP Interviews 2014)

This sense of shared community despite differences is based in large part on the cohesiveness of long-time community members. Ancestry and heritage provide strong links to the past and looking out for family members, friends, and neighbors is a tradition and source of pride. In addition, local social organizations such as the Lion's Club, churches, and volunteer fire department function as a key safety net for food, funds, transportation, or other needs. As one come-here said: "[if] you get in trouble, the whole community will rally around that, even when you're not necessarily one of them" (DIMCP Interviews 2014). Despite their low population numbers, the area still has a functioning volunteer fire department, church youth

group, and alcoholics anonymous group—social supports you would expect in more populous areas.

With the addition of newer residents, older residents see changes in the community's composition. One local resident said: "The whole complex of the community has changed, whether that's good or bad, I don't know. We've got a lot of people moved in, got different ideas than we got. In some ways that's good, you know" (DIMCP Interviews 2014). These new ideas are coming from the come-heres. While some come-heres do not engage in civic activities (just like some of the long-time residents), others have become champions for the area and are trying to preserve its cultural heritage and socio-economic existence. They are supporting the community both with the purchase of their home: "the come-heres [are] the ones that are bringing in the money" (DIMCP Interviews 2014): but many are also becoming engaged in the civic organizations mentioned above. A particularly good example of this is the leadership role that some come-heres are playing with Skipjack Heritage, Inc., (the local heritage organization working to promote heritage tourism in the area.

Older community residents and newer community residents are working side by side to support the community. And while their resilience as a community stems largely from this shared civic sense and duty, it also has to do with an ability to "make do:" "most of the people […] are pretty poor. But they make do. And since they're used to making do, they can ride through a crisis much better. It seems that way" (DIMCP Interviews, 2014). The relatively low economic status of many in the Deal Island Peninsula area has meant that they are adept at strategizing to make a living and solving problems. But this is not simply an economic strategy of

individuals or households, but a shared sense of community effort. Strong community ties are a big reason why the Deal Island Peninsula area communities are able to cope and adapt with their vulnerabilities. The best description of this came from one of the DIMCP stakeholders who is not a local resident. He described the "mutual interdependence" of the communities this way:

> You know, we see something that I have had an opportunity to observe in those communities there that for them is a way of life. It is consistent. It's constant. And that is a mutual inter-dependence with one another that we often see only in the wake of disaster in other communities around the country. And I don't believe that it is because they've suffered through disasters. Of course they have suffered through some. I don't think that it's only because there is impending change on the horizon with sea level rise and other stressors. I think it's just because it is. You know, that close-knittedness is something that I predict will become a universal necessity in our American society moving forward. As we change, as we learn how to live differently on the planet. We always hear, oh, Americans really, you know, rally and come together around whatever it is, 9/11 or Katrina or -- you know, the delayed response, the after response, I guess, or most recently with Sandy. Isn't it great how the community came together and helped one another, you know. Well, why does that end in those communities after things are put back together? Here, things are put back together and those ways of behaving with one another and those ways of supporting one another within communities, across communities, doesn't go away. It doesn't go away. (DIMCP Interviews 2014)

A Resilience State of Mind

The beauty of nature is important to people living in the Deal Island area, for both long-time and more recent residents. One interviewee put it quite succinctly in describing her communities continued residence here: "Without the beauty of the environment we wouldn't be living down here" (DIMCP Interviews 2014). There is a tie between the people and the natural environment, and that link for long-time residents has to do with resourcefulness, independence, and faith in God. Residents see value in maintaining their culture and communities into the future for as long as they can. Obviously, the issue of timescale is an important one, and residents realize

that change stemming from climate change impacts will not happen all at once. Therefore, there is some room to try to decide what the best course of action is and what they will be able to do about it:

> If you've got people with good intent, there's always a good and positive with that. But again, you know, I could sit here and say, you know, it's going to be under water eventually, but, you know, we can make—we can—it's our determination as to do we let it go under water in 50 years or under water in 100 years? That's a 50 year difference. Now, you know, it's—it's not like everybody's going to pick up and move tomorrow […] things just don't happen that way. (DIMCP Interviews 2014)

People in the Deal Island Peninsula area have resilience: they have crafted livelihood strategies that enable them to make a living. They have relied upon those forces in the natural environment that can help them sustain their ways of life, and they have not lost their faith, independence, or resourcefulness despite what seem like overwhelming odds against them. Moving forward, at least some residents are encouraged to be able to work together and engage on this issue. One resident outlined his hopes this way:

> But if we just kind of engaged and worked together and we had more faith maybe in what we were doing, I would feel less anxious about it. Like, okay, the world is going to change dramatically, it's going to change dramatically anyway. But I feel like if we could engage in an honest dialogue about it and engage and learn about it, even if, you know, we have to live in a very engineered world, we could still be trying to improve that or create more of what we wanted in our relationship to the environment and thought about our relationship—to me, that would be a good example of being resilient. It's not any particular state. Maybe it's a state of mind and a state of engagement. And a sense of community around it. And a diverse community. (DIMCP Interviews 2014)

Working together and planning for climate change are important for the future. But residents are viewing the future realistically. One resident said: "I think [throughout] the Chesapeake Bay, there's a major change coming and I don't know what we're going to do about it but live with it" (DIMCP Interviews 2014). While some may read

his words pessimistically or fatalistically, he is emphasizing an important point that adaptation to climate change will be part and parcel of life moving forward, a process that people will have to live through. Another resident put it somewhat differently: "What would it mean to be resilient to climate change? Resilient. I mean, do what you can and then accept." (DIMCP Interview 2014). Resilience for people in the Deal Island Peninsula area is in doing the best they know how and being realistic about the limitations that nature and God provide. This practicality has served them for generations, and will continue to do so into the future.

Conclusions

This chapter has explored resiliencies identified for the Deal Island Peninsula area by local DIMCP stakeholders, along with additional information to help contextualize the sources of resilience. Resiliencies identified by local Deal Island Peninsula area residents include: marsh and marsh grass, protected shorelines, blue crab fishery, ability to handle flooding and storms, faith and closeness to nature, independence and resourcefulness, social networks and community, and resilience as a state of mind. Many of these resiliencies are localized in the Deal Island Peninsula area and may not be readily recognizable to community outsiders.

The resiliencies depend very much on your perspective. For example, protected shorelines (with bulkheads) may not seem resilient in the way that living shorelines might. Some people see the protected shorelines as a source of resilience in protecting resident's land. Others, however, may see living shorelines as a better option because they enable the shoreline to move dynamically according to the environment's requirements. From this perspective, a protected shoreline can seem

like a vulnerability. Or, for example with regard to the resiliency of marsh grasses, some may feel that marshes will not be able to keep pace with sea level rise through accretion. However, for the resiliencies outlined above, local community members see clear value, benefit, and protection in these attributes.

Local residents were also clear in their understanding of having a stewardship role in relationship to the environment. A very good example of this is with the blue crab fishery. Watermen know that the crab has the potential to be resilient if it is not disrupted by pollution and other human activities. They see themselves as fulfilling a stewardship role in their work catching crabs, but also understand that they are not in control of nature and the environment. At least for the near future, some see the blue crab as a resilient attribute of the Deal Island Peninsula area. If the resource can be maintained and the overall environment not degraded through human activities, they believe crabs will continue to thrive. The closeness to nature stems not only from these working relationships but also from the close proximity of their homes to the marshes and waters of the Chesapeake Bay.

There is considerable experience and skill within the local communities to address negative impacts related to climate change, at least up to a certain point. As work to understand and accommodate impacts from climate change continues, it will be long-standing skill and experience that local community members draw upon in order to manage day-to-day living. Experience with recent storms and knowledge of past storm events drive local decision making about coping with future storms as is evident from information presented in Chapters 7 and 8 on Hurricane Sandy. This experience and skill lends itself not only to coping in times of crisis, but also to

adapting to more daily concerns such as high water and standing water. The capacity to address vulnerabilities in Chapter 7 through the resiliencies presented here in Chapter 8 are due in large measure to the strong local social networks and community resources that local residents, and now come-heres, have maintained.

For Deal Island Peninsula area residents, resilience is a cultural value that extends from their conceptualization of their relationship with nature all the way through their interactions with one another. Communities and the environment work in close connection to each other. Many local residents appreciate the natural environment and feel a sense of pride and gratitude in their experience of it. For a substantial proportion of local residents, this closeness with nature also reflects their faith and trust in their relationship with God. The resiliencies described here are specific to communities in the Deal Island Peninsula area and depend on arrangements of environment, people, and experience and history. And yet, these resiliencies from the environment, physical structures, social relations, adaptive capacity and positive outlook can be easily understood from an outside perspective.

Resiliencies described in this chapter address many of the vulnerability concerns highlighted in Chapter 7. However, additional perspectives are needed to build a more complete picture of vulnerability and resilience to climate change for the Deal Island Peninsula area. In the next Chapter, I will include some additional information from nonlocal perspectives in order to better contextualize local resident's insights on vulnerability and resilience for the area. In Chapter 10 I will use this information to construct a better understanding of vulnerability and resilience at the social-ecological system level.

Chapter 9: Nonlocal Insights on Vulnerability and Resilience

In the two proceeding chapters I describe local perspectives regarding vulnerability and resilience for the Deal Island Peninsula area. The chapters provide many useful perspectives but additional insights from a nonlocal perspective are necessary to develop a more holistic view of vulnerabilities and resiliencies. In this chapter I present scientific, economic, demographic, governance information as well as perspectives from DIMCP nonlocal stakeholders to provide additional depth and coverage of several key topics. These topics are organized according to how closely they relate to the local perspectives given in Chapters 7 and 8. Some topics enhance and support coverage provided by the local perspective while others introduce new topics not discussed by local stakeholders. The first section, "Additional Data to Enhance Local Perspectives," includes changing demographics, economic instability, and shoreline erosion and land subsidence and enhances previously discussed findings. In the following section, "Additional Factors from a Nonlocal Perspective", I briefly introduce additional topics mentioned by DIMCP stakeholders, but not by locals. These topics are: historic sea levels, salt-water intrusion, isolation, and the local style of development. Combined, these topics help us understand the differences between the way locals and nonlocals define the area's vulnerability and resilience. The next section, "Key Vulnerability Issue Areas from a Nonlocal Perspective," discusses three topics that surfaced during discussions with nonlocal stakeholders. These topics: marsh degradation, flooding, and environmental governance, are very important to DIMCP work, continued research in the area, and to discussions about climate change adaptation planning. Therefore, it is important to recognize and

describe them despite the fact that they did not seem to be primary areas of concern for local residents. In the final section, "A Key Resilience from the Nonlocal Perspective," I will discuss resilience identified as 'facing challenges together.' With the addition of this information to previously introduced topics, this chapter builds a more complete picture that enhances the perspectives presented in Chapters 7 and 8 to allow for better understanding of vulnerabilities and resiliencies across the social-ecological system of the Deal Island Peninsula area.

Additional Data to Enhance Local Perspectives

This section further describes a few areas of concern related to vulnerability to climate change for the Deal Island Peninsula area. These topics were discussed in Chapter 7 or Chapter 8 from the perspective of local residents. These topics include: demographics, economics, erosion, and land subsidence.

Demographics

The demographic change experienced in the Deal Island Peninsula area is similar to that experienced in other rural areas with declining populations. This change was briefly introduced and discussed in Chapter 2 from a historical perspective. In Chapter 7, I provided the local stakeholder perspective about this demographic change, particularly in relation to declining population numbers, an aging population, and fewer young. Yet, as was discussed in Chapter 8 the local community members feel confident in their strong social networks and in support to one another despite these ongoing and long-standing changes. Here, I provide some additional data that supports historic findings and local resident insights about the structure and scope of demographic change.

Within the context of the Mid-Atlantic region, the Deal Island Peninsula area and other rural communities around the Chesapeake Bay have not been representative of regional demographic trajectories. Somerset County has stayed remarkably stable in population numbers, unlike many other places in Maryland. Since 1900, the total population of the County has stayed nearly static (25,923 vs. 23,440 in 1990) while other counties have had significant growth (Forstall 1996, 74). For example, Prince George's County grew by over 2730% in the same time period (Forstall 1996, 74). Somerset County has retained its form and identity as a rural county on Maryland's Eastern Shore. The Deal Island Peninsula area has followed neither of these trends and has lost a significant portion of its population over the past century.

Information on the demographics of the very small communities in the Deal Island Peninsula is not easy to find because most methods of data collection aggregate them into larger units. But some data are available. In 1918 Lefferts estimates that the town of Deal Island, MD alone had at least 1000 people (this does not include Dames Quarter, Chance, or Wenona) (Lefferts 1918, 53). And, a 1940 Maryland Writer's Project publication featuring driving tours of the Deal Island Peninsula gives a combined population of 2,730 including Dames Quarter (565), Chance (628), Deal Island (1237), and Wenona (300) (O'Conor 1940, 429-430). Local residents report that after World War II the population declined as younger residents migrated to find more stable and lucrative employment opportunities in nearby towns and cities (DIMCP Interviews 2014). Recent census data (Table 2) help

construct a more detailed view[6]. Based on these statistics for some of the area's communities, the population of Deal Island, MD is estimated to have gone from about 1000 people in 1918 to about 420 people in 2014, a 50% reduction in nearly 100 years. But the more recent trend, after the height of population in the 1940's, is even more dramatic. The combined population of Deal Island, MD and Chance, MD went from 1537 in 1940 to 578 in 2000—a more than 60% reduction in 60 years. The more recent trend in continued population reductions from 2000 to 2014, which is just over 20% in just 14 years, are also concerning. These declines raise a number of important questions: Will population continue to decline at the same rate? What will this mean for the strong social networks locals currently depend upon?

Table 2: Deal Island Area Community Populations, 2000-2014

		Census Designated Place:			*Total by Year:*
		Dames Quarter	Chance	Deal Island	
Year:	2000	188	377	578	1143
	2010	142	353	456	951
	2014*	177	300	419	896

*estimated

Information from U.S. Census Bureau American Fact Finder 2015

Nestled beneath these broader demographic trends are specific trends that local residents highlighted including an aging population and lack of young. And indeed, the proportion of youth is lower and proportion over 65 higher than in other parts of Maryland. A large and increasing percentage of residents are over 65 (Table 3). From 2000 to 2014 the proportion of older residents increased by 18%. It is

[6] For all of the U.S. Census Bureau statistics, inhabitants of Wenona are included under the totals for Deal Island.

estimated that nearly 40% of Deal Island Peninsula area residents are over 65 in 2014 whereas for the state of Maryland only 13% of residents are over 65 (U.S. Census Bureau 2015). And, this aging population is not being replaced or renewed with children or young adults (See Table 4 for the area's population of children). For the Deal Island Peninsula area only about 11% of the population is under 18 whereas that number is nearly 23% for the state of Maryland (U.S. Census Bureau 2015). And, there has been a 10% reduction in the number under 18 in the past fourteen years. The combined trajectories of overall population decline alongside the age-structure of the population means that the Deal Island Peninsula seems, at least based on these statistics not to be sustainable into the future.

Table 3: Deal Island Peninsula Area Population over 65, 2000-2014

		Census Designated Place:			*Total:*	*Percent of Total Population:*
		Dames Quarter	Chance	Deal Island		
Year:	2000	35	84	109	228	19.9%
	2010	44	80	130	254	26.7%
	2014*	19	183	136	338	37.7%

*estimated

Information from U.S. Census Bureau American Fact Finder 2015

Table 4: Deal Island Peninsula Area Population under 18 Years, 2000-2014

		Census Designated Place:			*Total:*	*Percent of Total Population:*
		Dames Quarter	Chance	Deal Island		
Year:	2000	36	71	123	230	20.1%
	2010	10	52	13	75	7.9%
	2014*	43	18	36	97	10.8%

*estimated

Information from U.S. Census Bureau American Fact Finder 2015

As we have seen in Chapter 8 local community members still see a viable and functioning community whereas outsiders may or may not. This is an important point. People, even outsiders, see value within the community that is unique and important to maintain into the future. One DIMCP stakeholder, a nonlocal resident, saw a "coherent community," even though small:

> There's just a strong community there and there's a strong heritage. And it's a coherent community, as opposed to maybe some places along coasts where, you know, there's a lot of people that aren't necessarily knowing each other and having a history together. (DIMCP Interviews 2014)

In addition, as mentioned earlier the come-here population is playing an increasingly significant role in the function of community organizations and support. Demographic data specific to the come-here population is lacking, but it is certain that without the influx of these second and vacation home owners and retirees the population would be even less. These come-heres may play a role in the significant increase in percentage of population over 65. It is doubtful, however, that the addition of this population is affecting the decline in youth. This trend is likely to be linked instead to economic pressures on the community such as that described by the African-American resident in Chapter 7 about her children's inability to find skilled employment nearby.

Economic Instability

Economic changes are being driven by loss of opportunities in the community and broader cultural changes affecting the region, such as urbanization. Economic marginalization of the Deal Island area is not out of the ordinary for small rural communities in the region. Decline in population has been spurred by lack of stable livelihood options in many rural communities. Interestingly, the Deal Island

Peninsula area even had a higher median household income than that of Somerset County for the past fifteen years, until 2014 (see Table 5). In 2000 the area's median household income was $10,000 above Somerset County, but by 2014 it was lower. There is a significant and growing disparity for Deal Island Peninsula area communities when compared to the United States and Maryland (Table 5). In 2000, the Deal Island Peninsula area's median household income was higher than that of the United States, and within $10,000 of Maryland's median household income. But by 2014 the median household income for the Deal Island area is approximately $36,000, significantly lower than the United States at $53,657 and Maryland at $73,850 (Table 5). This means that the residents of the Deal Island Peninsula area are making do with far fewer financial resources than others in the State and Country, and even within the rest of rural Somerset County. Just like the local residents, nonlocal DIMCP stakeholders also recognize that this financial security plays a large role in people's decision to stay or go: "They either move away or become mechanics…somewhere. Or they stay there and live as their families have lived, which means they're vulnerable" (DIMCP Interviews 2014).

Table 5: Comparison of Median Household Incomes (U.S. dollars), 2000-2014

		United States	Maryland	Somerset County	Average for Deal Island Peninsula area
Year:	2000	41,990	52,740	29,618	43,229
	2010	50,046	68,993	38,134	42,382
	2014*	53,657	73,851	38,376	36,027

*estimated

Information from U.S. Census Bureau American Fact Finder 2015

Only between 18% and 28% of the total population in Dames Quarter, Chance, and Deal Island (including Wenona) are employed and supporting the rest of the population (Table 6). These figures may indicate that median household income is not the best estimate for families in the Deal Island Peninsula area since many households may have non-working adults. But this estimate is still probably more appropriate than average household income. The contribution of come-heres to this picture of financial health is also unclear. The relative financial security of come-heres may actually inflate the estimated stability of the long-time local population at $36,000 per household per year, or as retirees they may not have very high incomes and so are not affecting these numbers. Without additional micro-scale analysis there is no way to know the distribution of financial stability throughout the communities.

Table 6: Employment Statistics, estimated for 2014

		Place:			*Total Number Employed by Sector:*	*Percent of Total Employed by Sector:*
		Dames Quarter	Chance	Deal Island		
# of People Employed by Sector	Private Wage & Salary	16	37	42	95	40%
	Government	14	35	50	99	41%
	Self	20	16	9	45	19%
Total Number Employed by Location:		50	88	101	239	
Employed as Percent of Total Population:		28%	18%	22%		
Percent of Employed in Farming, Fishing & Forestry Occupations:		20%	18%	22%		

Information from U.S. Census Bureau American Fact Finder 2015

One indication of disparities in financial security is the poverty levels for residents in the Deal Island Peninsula area. The Federal Poverty guideline level for 2014 is $15,730 for a two-person household and $19,790 for a three person household (U.S. Department of Health and Human Services 2014). In the Deal Island Peninsula area the average household size is approximately 2.5 people (U.S. Census Bureau 2015). In Dames Quarter 40% of the population lives on income under the poverty level while in Chance it is only 1% of the population (U.S. Census Bureau 2015). See Table 7 for a comparison of these statistics. This poverty also skews across generations. In Dames Quarter 53% of people over the age of 65 are impoverished whereas for Deal Island that number is 75% for individuals under the age of eighteen. Overall, the individuals in Chance seem to be doing quite well by comparison to the other communities. Additional research on this topic to determine and strengthen financial security in the communities and sub-populations is warranted.

Table 7: Estimated Poverty Level, 2014

		Census Designated Place: Dames Quarter	Chance	Deal Island
Age:	< 18 years	35%	0%	75%
	18-65 years	39%	4%	22%
	> 65 years	53%	0%	22%
	Total population	40%	1%	23%

Information from U.S. Census Bureau American Fact Finder 2015

Many people understand the watermen's lifestyle to be less lucrative than it used to be, as mentioned in Chapter 7 (DIMCP Interviews 2014). And in fact, the

2014 U.S. Census estimates show that less than 22% of employed individuals in each community report working in "farming, fishing & forestry" occupations (U.S. Census Bureau 2015). These numbers demonstrate that the shift away from watermen's activities and other natural resource livelihood based activities has already occurred. Many watermen have a spouse or family member who has employment outside of the community to provide financial stability and benefits such as health insurance. This combined livelihood strategy works well for many families to ensure a stable income. Interestingly, employment is neatly divided between the private sector (40%) and the governmental sector (41%) with only 19% of individuals reporting they are self-employed. Table 6 gives more detail on these numbers. These figures reveal that almost all Deal Island Peninsula residents find it impossible to rely solely upon local employment opportunities.

A negative repercussion from these changes in the community, both population decline and a move away from traditional livelihood activities, has led to a lack in civic participation. Part of this may be due to people spending less time in their local community, but also because people are no longer linked to one another through work and day-to-day activities. This lack of capacity in civic participation is noticed by locals, as mentioned in Chapter 7, but also by nonlocals. One DIMCP stakeholder said:

> You have these old-timers and interesting characters that have done so much with their lives and all this stuff that they're interested in and, you know, work on the water, being a preacher, whatever it is, I mean, being in the fire company—and how many young people are in the fire company? How many young people are in the Lion's Club? How many young people go to the church? Like, those really fundamental aspects of the community that aren't being reinvigorated by the next generation. (DIMCP Interviews 2014)

While in many instances the come-heres have become socially active and have begun to take leadership positions in local organizations, there is some concern that in a few years many of these traditional community support systems will falter due to lack of membership. There are not enough younger and middle-aged people who are able and willing to fill the same roles in the community.

It is difficult for people to make a living without driving thirty to forty or more minutes each way to off-island employment. But this economic instability in the Deal Island Peninsula area is not a concern only for local families and households. It also has larger repercussions for the overall community's ability to adapt to climate change impacts. For example, one DIMCP stakeholder said: "Poor communities are not going to be as well prepared to adapt just because of lack of resources" (DIMCP Interviews 2014). Most locals do not have the financial resources to implement drastic measures, either themselves as individuals or through ties to regional, state, and federal assistance. In other coastal communities large scale fixes such as levees or dykes have been used to control water but in the Deal Island Peninsula area it is up to local landowners alone to manage their own properties—at least at present. As should be evident from these statistics related to the area's economics, very few residents have the means to put any sizeable sum of money toward these efforts. The area's economy points to financial precariousness and instability for local residents. This produces individual, household, and community risk to climate change impacts and demonstrates the area's limited means from which to draw upon for costly adaptation options.

Shoreline Erosion

Deal Island Peninsula area residents, especially those who live along the shoreline, feel particularly strongly about the potential vulnerability they face from future erosion. But, erosion is a natural and dynamic process for the Chesapeake Bay area that assists in the redistribution and creation of coastal shorelines. In a 1918 thesis, Lefferts describes the forces of the Chesapeake Bay this way:

> The Bay manifests itself as one of the most active agencies in changing the surface. Its waves cut away the high shores, change peninsulas into islands, and then devour the islands. To compensate for this destruction, however, it builds up the tide marshes that hold the richness lost from the uplands. It is both a destructive and a constructive factor, and its importance, as a geographic control must be fully appreciated. (Lefferts 1918, 9)

Erosion occurs on a daily basis due to waves, wind, currents, and tides and can also be propelled by strong storms and other weather. However, erosion for the Deal Island Peninsula area has been measured to be more drastic than in other nearby locations. The average shoreline erosion rate in Maryland is one foot per year while rates of erosion for some areas of the Deal Island peninsula are eight feet per year (Maryland Department of Natural Resources 2008). For a look at an example of estimated coastal erosion for a portion of the Deal Island Peninsula area please see Appendix G.

This has dramatic implications for the Deal Island Peninsula area as sea levels continue to rise. As was mentioned in previous chapters, local residents can point out particular areas around the Deal Island Peninsula area they understand to be affected by erosion more significantly than average. In some cases erosion is becoming a concern not only for shoreline homeowners, but also for those farther inland for whom altered coasts and waterways threaten them with greater flooding (DIMCP

Workshop January 2016). As the basic structure of the Deal Island Peninsula area land mass may change with erosion, the future ramifications of erosion are really just beginning to be understood. While measurements of yearly erosion and data showing past erosion are relatively easy to obtain, projections for future erosion are not well understood and are quite uncertain.

Land Subsidence

Another significant factor of environmental change is land subsidence, as locals would say, "land sinking." In Chapter 7, coverage of the local perspective on this issue dwelled on local's understanding and reaction to the problem. But there is a larger regional context for land subsidence. Along the Atlantic Seaboard, land subsidence is greatest in the southern Chesapeake Bay region (located just to the south of the Deal Island Peninsula area) and has been measured up to 5mm per year (Eggleston and Pope 2013, 2). This subsidence is important in the Chesapeake Bay region, accounting for nearly half of the relative sea level rise currently experienced (Eggleston and Pope 2013, 2). Land subsidence increases the effects of sea level rise and flooding, but can also negatively impact marsh composition and exacerbate shoreline erosion (Eggleston and Pope 2013, 6). Marsh drainage and degradation of organic soils can also cause local land subsidence (Eggleston and Pope 2013, 14).

A study in the southern Chesapeake (in the vicinity of Norfolk, VA) gives subsidence rates of 1.1 to 4.8 millimeters per year (Eggleston and Pope 2013, 2). Here, subsidence is caused by two factors. The first is natural and a result of ongoing geological shifts after the last ice age and glacial melt. The second cause of subsidence is both broader and human-driven land compaction from groundwater

extraction, estimated to be between 1.5 and 3.7 millimeters per year (2). It is unclear the extent to which geological shifts versus groundwater pumping is a factor for the Deal Island Peninsula area. The tidal station used for these subsidence measurements is over eighty miles away, to the south, in Kiptopeke, VA. The subsidence could possibly be less in the Deal Island area than in Kiptopeke, but marsh alteration is not a factor for Kiptopeke (9) whereas it could be for the Deal Island Peninsula area. While uncertainty about the particular causes of local land subsidence, this additional scientific information helps to help better illustrate the problem and also demonstrates how land subsidence is a complicated natural and human-caused process.

Information in this section serves to enhance the picture of vulnerability presented through the local community's perspective. Demographic change, economic instability, shoreline erosion and land subsidence were all discussed by local community members and this additional data helps to clarify historical trends, regional contexts, and larger implications of these factors to climate change adaptation processes.

Additional Factors from a Nonlocal Perspective

A few additional factors of vulnerability are relevant to the Deal Island Peninsula area, including vulnerabilities such as historically changing water levels, salt-water intrusion, isolation, and the local style of development. Local stakeholders did not mention these topics but I want to discuss them further as important input from nonlocal stakeholders. Salt-water intrusion, isolation, and the local style of development were each mentioned as vulnerabilities for the Deal Island Peninsula area. Historical change in water levels was a topic that I investigated because of the

conflicting views from science related to recent sea level rise and reports from some local stakeholders that the land had not changed very much until recently.

Historic sea levels of the Chesapeake Bay were lower than today. Kearney (2012) discusses the finding of fossilized tree stumps surrounding Deal Island, MD. The trees were dated to approximately 790 years before present and had grown to be at least two hundred years old (982). Their position under today's surf indicates a difference in land and water, and also in groundwater that would today be too high and brackish to support trees of that size (982). Kearny indicates that sea levels were within a meter of modern levels within the past 1400 years and probably rose only about .5m over the last 1000, but evidence points to swifter sea level rise in the past 100 years (Kearney 2012). This means that for the majority of time that Western peoples have been living on the Deal Island Peninsula area, water levels have been extremely stable. Interestingly, local environmental knowledge of the recent past also supports this understanding of stable water levels, and only in recent decades have people begun to take notice of rising water levels (DIMCP Interviews 2014). While water in recent history has been stable, there is precedent in the geologic past for more variability. This understanding helps to place the current changes experienced in the Deal Island Peninsula area in full historical context and also corroborate local environmental knowledge. While knowledge of this deep geologic past may not be immediately relevant to understanding future vulnerability and resilience to climate change, acknowledgement of the validity of local environmental knowledge is important and helps to bridge scientific and local knowledge.

Rising seawater and a rising water table each contribute to saltwater intrusion (e.g., the progression of salt and brackish water inland). Saltwater intrusion can be caused by rising sea levels and is also due to withdraws of fresh groundwater (Needelman et al. 2012, 19). This allows salt water to enter into formerly freshwater areas. This vulnerability was identified by a few nonlocal DIMCP stakeholders, most likely due to negative effects that damage or destroy plant and animal communities (15). Driving out to Chance, Deal Island, and Wenona you can see several stands of trees that are dead or dying as their territory is converted to salt marsh. This change in the fresh and salt water dynamic will affect the landscape, marsh, as well as plant and animal communities. It is possible that the phenomenon of saltwater intrusion was not mentioned by local Deal Island stakeholders because the dead trees are instead understood to be the result of the overall water table rising or the sinking of land and its conversion to marsh. For local residents the uncertainty and conflict inherent to this issue may be similar to that of the conversation in Chapter 7 regarding the land sinking or water table rising—there may be no clear answer.

As described previously, the Deal Island Peninsula area communities are surrounded by water and distant from the mainland and many public services. Residents appreciate their ruralness and isolation. But, having only one main road traversing marsh can also seen as isolation that contributes to increased threats. One nonlocal DIMCP said:

> It's a low land, so that makes it very vulnerable and it's right by the water. So being low and right by the water just makes it the perfect place to get flooded with any changes in water levels. (DIMCP Interviews 2014)

Interestingly, local residents did not mention isolation or distance from the main town centers as a source of vulnerability. Most likely, this is because they see their

surroundings more as a source of peace and quiet in being surrounded by the beauty of nature (DIMCP Interviews 2014). In addition, this "isolation" is quite normal for them and they see it just as the way things are. But from the outsider's perspective, this isolation connotes great vulnerability in being distant from emergency services and in placing the communities closer to threats from wind, waves, and storms. Especially for those accustomed to urban areas, the Deal Island Peninsula area seems very remote.

Nonlocal stakeholders were also concerned with the style of development of the area as a contributor to vulnerability. Most saw great susceptibility to threat in the way historic homes are low to the ground, and in types of development that are not designed to weather floods and storms. Newer homes and buildings must meet flood plain regulations but older structures are increasingly vulnerable to flooding, especially depending upon their elevation and distance from the Tangier Sound or other bodies of water. Most local community members do not have the financial resources to retrofit old homes and businesses voluntarily and this will become an increasingly large concern as rising waters begin affecting buildings and home sites.

Each of these items: style of development, isolation, salt water intrusion, and changing water levels, help to better illustrate some additional concerns related to vulnerability and resilience for the future. Local residents of the Deal Island Peninsula area did not identify these issues but they are still important topics for discussion of vulnerability and resilience. These different perspectives that nonlocals have and bring to the DIMCP enhance our overall understanding of the area and give some indication of additional concerns to keep in mind for the future.

Key Vulnerability Issue Areas from a Nonlocal Perspective

In this final section I would like to further develop three key issues related to vulnerability that are important from a nonlocal perspective. These issues are marsh degradation, flooding, and environmental governance. Although these have been mentioned or hinted at in previous material additional focus is warranted to highlight the perspective and priorities that nonlocal DIMCP stakeholders have when compared to local residents. The understanding of locals can vary significantly from nonlocals, and the topics below demonstrate some key ways in which these two perspectives differ. If nonlocal DIMCP stakeholders see different vulnerabilities and resiliencies from local stakeholders there may be very different ideas about what work is needed to address these vulnerabilities and to build resilience. The concern here is not only that these two groups will have differing views but that differences in perspective can lead to miscommunication and conflict.

Marsh Degradation

Deal Island Peninsula area marshes are important because they comprise a significant portion of the area's landmass and also because they are one of the largest marsh areas in the Chesapeake region. Marshes are critical to local perspective of the landscape and also to nonlocal people who have an ecological interest in sustaining the area's marshes. Marsh degradation was identified by nonlocal DIMCP stakeholders as a vulnerability and is an important component of the Project's overall research and scientific marsh study. Marsh degradation means a decrease in the extent of the marsh but also changes to the plant and animal communities that live within the

marsh as well as altered hydrological conditions of the marsh itself (Needelman et al. 2012, 18).

Coastal marshes along the Atlantic seaboard are rapidly degrading due to sea level rise, natural regional land subsidence, and disturbance in the early 20th century (Eggleston and Pope 2013; Needelman et al. 2012). As this degradation continues, the worry is that marshes may not be able to keep pace with sea level rise and will be submerged, severely impeding their ability to mitigate storm surge and act as buffers of erosion and weather (Kirwan and Megonigal 2013). Marshes play a protective role for communities and ecosystems in times of flooding and storm surge, and if not degraded may be able to naturally accrete (grow vertically) and accommodate rising water levels to a certain extent (Kirwan and Megonigal 2013; Needelman et al. 2012). This ability of marshes to acclimate to change was also discussed by local stakeholders as mentioned in Chapter 8. A key component to protecting land and communities in the face of sea level rise and other inundations is the marshes ability to accrete and migrate upland (Needelman et al. 2012, 15-16).

In the case of Deal Island Peninsula marshes, early 20th century anthropogenic alteration in the form of extensive ditching and later physical and hydrological alteration of the marshes have most likely compromised the natural abilities of marsh to accrete (DIMCP Community Conversation September 2014). Chapter 7 mentions these disturbances from the perspective of the local residents. In the Deal Island Peninsula area, marshes were extensively ditched and then later large areas of open water and ponds were created to attract waterfowl (OMWM) (DIMCP Workshop April 2013). The marshes were altered to reduce mosquito populations and encourage

waterfowl reproduction, inhabitation and to support sport hunting of waterfowl (DIMCP Interviews 2014). All of these changes were intended to enhance human benefit derived from the area, particularly through supporting hunting and fishing industries.

In Louisiana, processes contributing to degradation of marsh through canalization and ponding is well documented (Oliver-Smith 2009). However, the impact from anthropogenic alteration and natural processes of degradation on the ability of Deal Island Peninsula area marshes to migrate upland is uncertain. Within the DIMCP, marsh degradation is a key project focus area as indicated by the creation of a collaborative research project on marsh restoration as well as a public community conversation that we had on the marshes. Ongoing and future work of the DIMCP will continue to address marsh degradation despite the fact that local residents themselves did not bring this up as a key concern in the DIMCP stakeholder interviews.

Flooding

Flooding is an important topic in the Deal Island Peninsula area. Many local residents have experienced flooding and are quick to tell you about storms and other flood occurrences. For example, the flooding experienced in Hurricane Sandy was discussed in Chapters 7 and 8. And some residents are very used to flooding. However, local residents did not discuss flooding as something that made them vulnerable to climate change, most likely because it is seen as a natural and ongoing potential threat to the area.

Most of area is classified as a flood zone, and nearly all of the WMA is within the one hundred year floodplain (a chance of flood on average once in one hundred years). Only a few of the denser settled areas are on high enough elevation not to be considered in a flood zone (Somerset County 2015). As Najjar et al (2010) point out climate change impacts for the Chesapeake Bay region will vary greatly depending on properties of human land use. Therefore, the position of one's house within the Deal Island Peninsula may matter greatly in times of flooding. In a recent DIMCP workshop (January 2016), projections for sea level rise and flooding impacted by sea level rise were prepared for local residents. These projections indicate that up until 2030 most of the current settled areas will be safe from flooding in all but the harshest storms. After 2030, more significant encroachment will occur upon settled areas (DIMCP Workshop January 2016). Therefore it would appear that threat from flooding to most people's homes is minimal up until 2030 except in cases of very severe storms.

Significant changes may be expected in the future, however. Not only will flooding risk increase but also the United States government regularly reclassifies areas based on their flood susceptibility. These data are used by insurance agencies to set flood insurance rates. Right now, residents consider the cost of flood insurance to be high, but not yet unmanageable (DIMCP Workshop April 2013). But the cost of future flood insurance is a concern for many local residents who think that they or their children will be pushed out of living in the area due to this constraint (DIMCP Workshop April 2013). While local residents do not identify flooding as a vulnerability to climate change in the semi-structured interview format, they clearly

associate flooding with some degree of future risk and uncertainty for the area. Therefore, flooding is a key topic for understanding vulnerability and resilience in the area and luckily, one that both locals and nonlocals are comfortable talking about.

Environmental Governance

Another factor leading to vulnerability noticed by DIMCP stakeholders is the structure of governance and management specific to the Deal Island Peninsula area. As mentioned earlier, the WMA and MBR are managed by MD-DNR at the state level. Local residents do not have a say in what happens on the marshes regarding ditching, the impoundment, hunting, scientific data collection, and other management decisions. Though familiar to them and used by them (especially when they were younger), residents have no ability to influence policy related to the marshes. For example, one interviewee said:

> You know, I think the community was fairly disconnected from a lot of things happening outside of the community. And people that were—you know, state government people that are active in the community managing—because a lot of the land is owned by the state—were not connected to the community. These lack of relationships are a huge factor in making the community vulnerable. (DIMCP Interviews 2014)

Because the state and local communities have not worked together in the past, and because regulation and policy have alienated local community members from the state level, community members and managers are not working together to plan for climate change except to the extent that both are now involved in the DIMCP. One stakeholder discussed it this way:

> …because they don't understand and they don't have relationship with planning agencies, State agencies. Many of them, for people born there, are historically independent minded and don't want government and outside help and things like that. So they're really at a disadvantage there. (DIMCP Interviews 2014)

Nonlocal DIMCP stakeholders discussed this issue to highlight a lack of mutual understanding between local communities and those responsible for environmental management. This is a concern because as impacts from climate change become more apparent and there are governmental initiatives to plan and adapt for climate change, local Deal Island Peninsula area residents' perspectives may be left out of any regulation or planning, both for the WMA and in terms of policies effecting individual landowners.

Many DIMCP stakeholders were quick to point out that local community members will also have to modify their traditional ways of doing things in order to make climate change adaptation a possibility. This includes both the management of their own lands, but also in having to accommodate policy and regulation from the state level. Even people from outside of the community, such as this DIMCP stakeholder, recognize that this is going to be a "painful" process for long-time locals:

> [we need to get the] community [to] realize that this [flooding and rising water] is an important issue to them and their future generations and that some of the things that we need to do to affect change are going to be painful government intrusion. (DIMCP Interviews 2014)

The lack of relationship described above is changing somewhat through the efforts of the DIMCP, but the gulf is long-standing and may take significant time to bridge. The resilience that local residents have in being independent and resourceful will support them in adapting to climate change in the future, but the lack of relationship with those making environmental management decisions may become a vulnerability as nonlocal stakeholders have indicated above. This is an important understanding for future DIMCP work moving forward.

A Key Resilience from the Nonlocal Perspective

Nonlocal stakeholders did not have many significant additions to items of resilience for the Deal Island Peninsula area—except one. Many nonlocal stakeholders consistently mentioned in interviews that it was important for local community members to work alongside one another to 'face challenges together.' This is a budding and developing resilience within the area but one that is incredibly important for continued work to cope and adapt with climate change. Nonlocal stakeholders described this cooperative effort as a unique and timely opportunity that could make a difference in the local area.

With comparative regional perspective, this nonlocal stakeholder described how this work was exciting and novel for the Chesapeake region:

> I'm excited because really smart people are devoting considerable thought to questions of resilience and mutual inter-dependence and adaptive capacity and contingency. Even if in the worst case scenario the Peninsula is swallowed up by the Bay and those communities as we knew them don't exist the same exact way in those same exact locations, the experience of having considered these challenges together and having developed potential solutions and contingencies together, to me, means that the true essence of the community will live on regardless of its position in the landscape. There aren't, that I know of, a lot of places around the Bay where that kind of galvanizing presence is the case. I don't want to use the term, you know, social engineering project. It's not that. This is a social self-realization project. And I don't know of too many places, or any places, where those kinds of conversations are going on in specifically in that way. So that's pretty exciting. (DIMCP Interviews 2014)

This is the kind of perspective that local residents may not have because they are not aware of other environmental management initiatives within the region. Nonlocal stakeholders also pointed out that it may be a good time to be working on these issues because there is some time before the problems of climate change become immediate. One stakeholder involved in the planning field said: "I am optimistic, I really believe [that] at least in the foreseeable future, the near future, let's say, the next 80 years, a

lot that's really bad is not going to happen. So doing this stuff now is good" (DIMCP Interviews 2014). The issue of facing challenges together is important to begin navigating now for work into the future.

This type of work should be viewed as a partnership, but one that needs direction, input, and energy from the local community in order to succeed. One nonlocal DIMCP stakeholder described it this way:

> "I feel like the community itself has the opportunity to shape what they look like doing forward. I feel it's really in their hands, you know. There isn't a governing structure. They—it's in their hands to understand what they want to look like as a community and then use Government or other resources to kind of help shape that." (DIMCP Interviews 2014)

Facing challenges together is a resilience that can empower DIMCP work. This is a key benefit that nonlocal stakeholders bring to the Project—their commitment to cooperative work and certainty that progress can be made by working together. Although local residents are accustomed to cooperating with one another, the step to draw in outsiders is unique and will take some time to fully develop. One nonlocal stakeholder related his understanding that locals have done what they could:

> I mean, that's a hard—a hard question, because I don't know what—you know, I don't really know what you do to build resiliency. Like, I can't think of—I can't think of what that means for that area, because they're already kind of so—the people down there are so independent and resourceful already, that I don't know what—what they would do that they haven't really done already. (DIMCP Interviews 2014)

This nonlocal DIMCP stakeholder has a practical view of local community members' relationship with the Deal Island Peninsula area. This view complements local resident perspectives presented at the end of Chapter 8 that they must do what they can and then accept what is happening in the world around them. But the additional recognition of this resilience by nonlocals that is both nascent and developing will

help the stakeholder network. It will broaden the community's capacity to act and respond effectively to the previously discussed vulnerabilities.

Conclusions

This chapter provides new and supporting information, much of it relating directly to vulnerabilities in the Deal Island Peninsula area. These topics are also tied to resiliencies identified through the local stakeholder perspectives. Many nonlocal stakeholders mentioned resiliencies described in Chapter 8. But one additional resilience, 'facing challenges together', helps to broaden the local perspective and focus on vulnerabilities and resiliencies at the social-ecological system level.

Information presented in this chapter suggests that nonlocal stakeholders highlight several concerns differently than locals. Focus on marsh degradation, flooding, and environmental governance issues are particularly important to nonlocal stakeholders. These emphases are reflected in the work of the DIMCP—an important point as nonlocals organize project activities. Other information supplements local's views. Together, Chapters 7 through 9 give a detailed look at items of vulnerability and resilience most important to local residents as well as nonlocal DIMCP stakeholders. Additional insight and understanding presented in Chapter 9 place the interests of local residents into larger contexts, bridging the needs of local community members with overall DIMCP objectives. The comparison of these views demonstrates a difference in perspective related to vulnerability and resilience that has repercussions for adaptation planning strategies moving forward. In the following chapter, I will return to the social-ecological systems level to add additional insight.

Chapter 10: A Social-Ecological System Level Analysis

This chapter presents new information that builds on understandings gleaned from previous chapters to provide a cross-system perspective of vulnerability and resilience for the Deal Island Peninsula area. Building comprehensive coverage across the area's social-ecological system requires both the ethnographically oriented data from previous chapters on local and nonlocal perspectives in addition to broad data collected on the DIMCP stakeholder level. The DIMCP stakeholders, as representatives of the system, are a tremendous resource for better understanding particular system components as well as strengths and weaknesses spanning the system.

In Chapters 7 through 9, I present local and nonlocal perspectives on climate change vulnerability and resilience for the area. But, why does this information matter? What advantages are found in conducting a detailed and ethnographically based analysis of vulnerability and resilience? What findings on vulnerability and resilience can be distilled for the Deal Island Peninsula area? Before these questions are answered I argue that we should pay more attention to how data are interpreted and understood in relation to each other both within and across the social-ecological system. Knowing and understanding the full scope of vulnerability and resilience helps to more accurately determine not only how climate change effects will be felt and accommodated but also the key information that stakeholders have in mind about their strengths and susceptibilities moving forward.

The distinction between generalized (system-level) resilience and specified resilience (of system components or sub-components) provides a helpful

organizational construct. Knowledge of the system and of system sub-components, as well as knowledge of vulnerability and resilience related to these scales varies greatly across the system and we cannot assume that there is uniform understanding and agreement about these details. Information in this chapter seeks to provide a better view of the generalized resilience across the Deal Island Peninsula area but does not do so to the exclusion of specified resiliencies but rather by building upon them and working through them. In the following sections I discuss vulnerability and resilience across the DIMCP stakeholder network, understanding of the relationship between vulnerability and resilience, and prioritization of vulnerability and resilience items for action by the DIMCP stakeholder network. This analysis attempts to transcend the local/nonlocal divide by combining insights from multiple stakeholders in dynamic conversation with one another.

Vulnerability and Resilience Across the Network

While vulnerabilities and resiliencies have been listed in the previous chapters, a more comprehensive view of items defined across the DIMCP is helpful give a broader perspective. The range and scope of issues important for coping with climate change is well represented by the condensed lists of vulnerabilities and resiliencies created through DIMCP research (mentioned earlier and presented below in Tables 10 and 11). I used both semi-structured interview data and data collected from workshops and community conversations to develop these comprehensive lists[7]. These lists represent the combined views of DIMCP stakeholders, including long-time residents, come-heres, part-time residents, environmental managers, officials

[7] As a reminder, the full lists are included as Appendices D and E.

with state, regional, and local institutions, DIMCP project leadership, and personnel from local and regional non-profit organizations. While not all of these people live in the area, all are involved with work, research, or issue areas pertinent to the Deal Island Peninsula area. Tables 10 and 11 are provided as an overview of the cross-system perspective.

Table 8: Condensed List of System Vulnerabilities

DIMCP Stakeholder Identified Vulnerabilities:
demographics: aging population; young leaving; newcomers (but new ideas good)
high water table; saltwater intrusion
isolation; disconnection; only one way in and out
lack of action to mitigate impacts; lack of acceptance of vulnerability
low elevation; land sinking
no control over natural and dynamic system
remote management (state lands) and governance (regulations, politics) limits choice and influence of locals
style of development; zoning creates vulnerability
surrounded by water; rising sea levels; rising tides
threat of storms, flooding and damage to waterfronts, wetlands and marsh
wave energy; currents; wind erosion; fetch
weak economics: lack of jobs; dependent on water; low incomes; declining fishery; limited livelihood options; limited ability to adapt

Table 9: Condensed List of System Resiliencies

DIMCP Stakeholder Identified Resiliencies:
can handle low flooding
close to nature; adaptive; creative
crabs and crabbing
ethic of cooperation; close-knittedness
independence; self-reliance
marsh; marsh grass; protection provided by marsh
northern shorelines; hardened shorelines
steadiness of environment and Bay through ebbs and flows
strong attachment to place; value history
strong faith
ties outside (place to go in storms)

Many of the items listed in the tables above were discussed in Chapter 7, 8, or 9. The earlier description of these individual vulnerabilities and resiliencies enables us to begin thinking about how perspectives align across the local/ nonlocal divide. Understandings of vulnerability and resilience are built upon experience and knowledge within the system. For example, the insight that flooding many not be a key vulnerability for local residents is very important in terms of how the DIMCP strategizes about climate adaptation options through the ICRA. Each vulnerability or resilience helps to reveal the way that DIMCP stakeholders understand and view weaknesses and strengths in the face of climate change impacts. Better understanding of interactions and realities across the social-ecological system will improve collaborative learning and help with planning in the future.

Viewing vulnerability and resilience on the systems level is necessary due to implications for environmental governance and climate change adaptation planning. It helps us to build answers to questions such as: What is the DIMCP network's capacity to move forward in the future? What are key areas of agreement and disagreement? How do key perspectives from within the system relate to that of the overall group? But it also mediates the divide between local and nonlocal interests and provides a format for understanding and incorporating these perspectives. In the following sections I will discuss data collected at the DIMCP stakeholder level, but will also emphasize local or nonlocal concerns within that data. In this way the local or nonlocal perspective will help to identify how well the overall social-ecological system perspective represents key interests of its constituents. Being able to attend to these three positions is important to maintain an appropriate level of complexity

within the analysis of vulnerability and resilience to climate change for this small region. Aside from this initial listing of vulnerabilities and resiliencies, in this chapter I would like to present data in two key areas: the relationship between vulnerability and resilience, and the priorities that local residents and the DIMCP stakeholder network have for future work on vulnerability and resilience. In the next chapter I will discuss further key areas of concern within the DIMCP stakeholder network.

How Vulnerability and Resilience Relate

Because my focus was on clearly defining vulnerability and resilience via stakeholder's perspectives through the DIMCP stakeholder interviews, I did not ask respondents to identify or discuss the relationship of vulnerability and resilience to one another. The importance of this information became clearer to me as interview analysis proceeded and differing perceptions and valuation of vulnerability and resilience across the network were identified. I questioned whether the categories of vulnerability and resilience were salient to stakeholders' own understandings or driven primarily by research questions. Was categorization of vulnerability and resilience shared across the full DIMCP stakeholder network? And, in particular do DIMCP stakeholders relate features of vulnerability and resilience to one another, and if so how? We designed a cultural domain analysis activity to assess these questions in order to better map vulnerability and resilience across the DIMCP stakeholder network. The activity included a pile sort, small group discussions, small group report-outs to workshop attendees, and full group discussion regarding the findings of vulnerability and resilience[8]. Other members of our network unable to attend the

[8] A fuller description of cultural domain analysis can be found in Chapter 6.

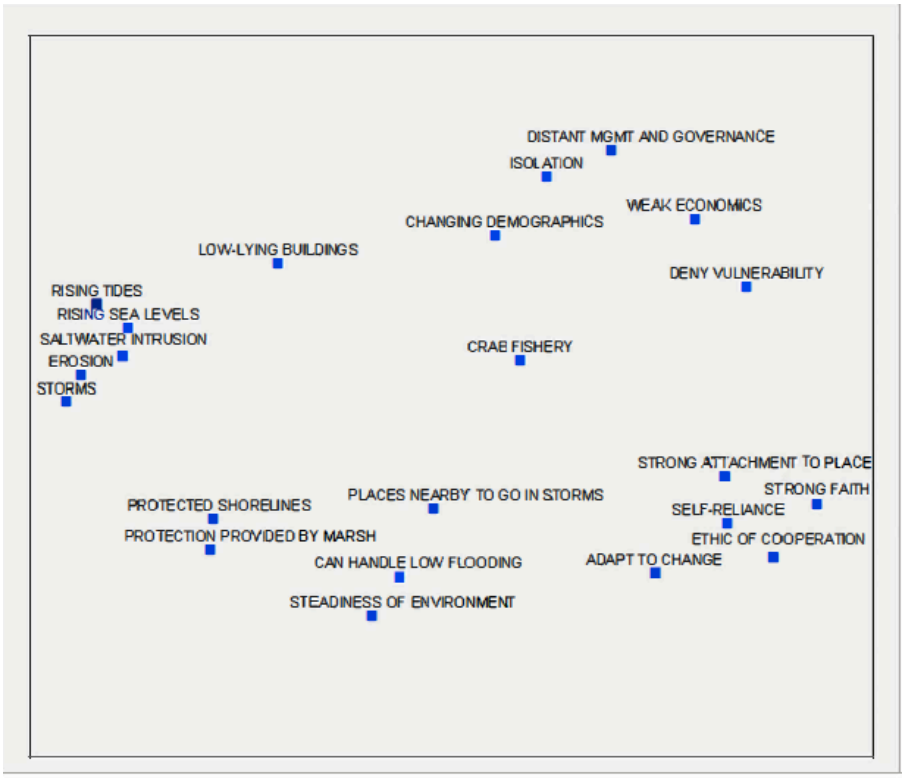
workshop were able to complete the pile sort analysis at home via mail and so still contributed to the cultural domain analysis. The results of this analysis are interesting because they point to the validity of the conceptual categories of vulnerability and resilience, to shared and unshared understandings of vulnerability across the social-ecological system, and demonstrate a need for both the vulnerability and resilience categories.

There are three types of data collected through the cultural domain analysis that I will highlight. Each figure below visually represents the relationship that stakeholders and subsections of stakeholders identify between and among vulnerability and resilience terms. The spatial proximity of each term indicates how closely or distantly terms were sorted with one another. Figure 9 shows the associations that the full DIMCP stakeholder network had for vulnerability and resilience terms. Figure 10 shows these data for only the nonlocal participants, and Figure 11 shows the data for local participants.

These MDS plots spatially represent similarities and differences in the sorting of terms by a particular group of people. Three types of information are important to interpret from the plots. First is the amount of "stress" that the plots undergo to produce the two-dimensional relationships. The stress statistic measures between 0 and 1 with anything below 0.100 being excellent and anything over 0.150 being unacceptable (Borgatti 1999). The stress levels for our plots range between 0.100 to 0.122. This means that none of our plots are an excellent fit to represent the data, but all are good representations of the data. Second are clusters within the data. These occur when there is a strong correlation in the way that participants grouped terms

during the pile sort activity. And third are arrays, the similarity or difference in the way the terms are organized according to the two hypothetical dimensions of the plot (Borgatti 1999).

Figure 9: Cultural Domain Analysis Results, DIMCP Stakeholders



The DIMCP stakeholder data represented in Figure 9 was compiled from forty-two respondents and indicate several key points about the relationship between vulnerability and resilience for the Deal Island Peninsula area. The stress for this plot is 0.122 after 13 iterations of running the data. This stress factor indicates that the MDS plot is a good, though not excellent fit with the DIMCP stakeholder data on vulnerabilities and resiliencies. The most obvious is a cluster including 'rising tides,'

‘rising sea levels,’ saltwater intrusion,’ ‘erosion,’ and ‘storms’ that occurs in the middle left hand side of the plot. These items are all environmental vulnerabilities and are very closely grouped. Their association shows that participants across the DIMCP stakeholder network consistently sorted these terms together and found these terms to be more alike than other terms. In fact, this tightly grouped cluster is also present in Figures 10 and 11. This means that the DIMCP network, as well as nonlocal stakeholders and local residents groupings, all share a strong level of agreement in correlating these environmental vulnerabilities with one another as opposed to associating them with other terms. This finding reveals that environmental vulnerabilities are indeed a category of cultural relevance for DIMCP stakeholders.

The second noticeable feature in Figure 9 is the way terms are organized with a clear division between the top and bottom halves of the plot. I argue that this division is representative of an array—one of the two dimensions of association on which the plot is based. As a reminder, multidimensional scaling analysis represents each term in a spatial relationship with one another based on correlation coefficients run between all terms. However, because it is impractical to view these relationships in a fully dimensional relationship with one another, the analysis organizes in two dimensions. The division between the top and bottom half of the plot indicates a vertical array correlated with vulnerability and resilience, respectively. This division shows a preference across the DIMCP stakeholder network for vulnerability and resilience terms to be grouped together. This means that the categories of vulnerability and resilience are meaningful across the stakeholder network as vulnerability and resilience terms were each grouped together.

The third attribute of Figure 9 that I would like to point out is the second dimension, or array of organization for the plot. From left to right in Figure 9 vulnerability and resilience terms are both organized from more ecological to more social features. Therefore, physical and ecological items such as 'erosion' and 'rising tides' occur on the left while 'strong faith' and 'ethic of cooperation' are positioned on the right. This organization reveals an underlying tendency for all DIMCP stakeholders to utilize the categories of vulnerability and resilience, and to associate these terms along a spectrum of ecological to social. These two arrays are also both represented in Figures 10 and 11. This means that the two arrays and environmental vulnerability cluster are salient to all stakeholder groupings.

Figure 10: Cultural Domain Analysis Results, DIMCP Nonlocal Stakeholders

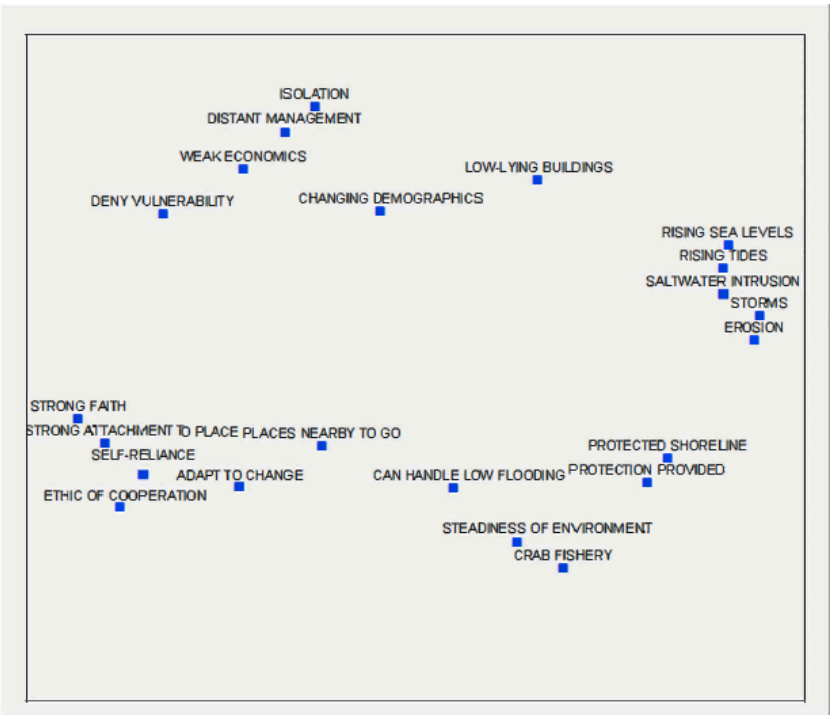
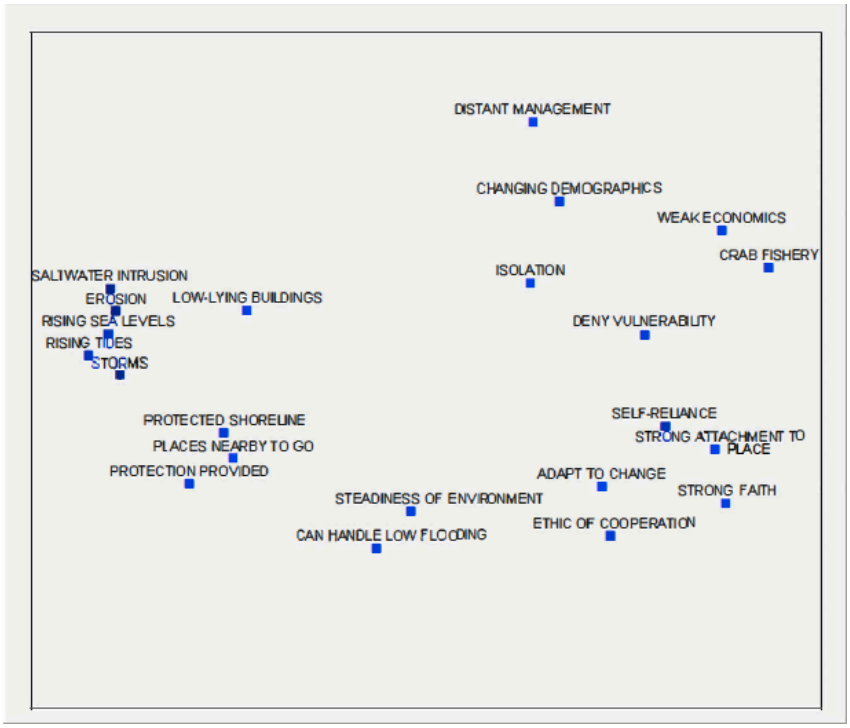


Figure 10 contains the MDS results for nonlocal DIMCP stakeholders only, twenty-seven respondents out of the original forty-two. In this way, we can compare whether nonlocal or local responses are driving the overall group's cultural domain analysis, or whether the group results do represent nonlocal views. Nonlocal stress is 0.107 after 13 iterations making this MDS plot the second best fit to data of the three plots. In this plot, the second data array (ecological to social) is also present, though its plotting is reversed. This is a difference in data organization by the software program UCINET and does not indicate any substantive difference in the way that nonlocal DIMCP stakeholders conceptually organize vulnerability and resilience terms. Terms are still all in approximately the same relationship pattern with one another as in Figure 9.

Only two minor observations differentiate data in Figure 10 from that in Figure 9. First, the division (horizontal space) between vulnerability and resilience is more pronounced in the nonlocal results than with the full DIMCP stakeholder network and may indicate a slight difference in the conceptual division between these categories for local and nonlocal stakeholders (Figure 9). And second, in Figure 10 the term 'crab fishery' is clearly identified as an ecological resilience for nonlocal DIMCP stakeholders whereas for the overall DIMCP stakeholder network (Figure 9) it is categorized ambiguously in the middle of the MDS plot. This difference may show nonlocal understanding of this term differs significantly from local characterization. Looking at Figure 11 (data from local residents) we can see 'crab fishery' is indeed positioned as a social vulnerability rather than an ecological resilience. This is interesting because 'crab fishery' was presented to the DIMCP

stakeholder network as a feature of resilience as a result of analysis of the DIMCP semi-structured interviews. Two key pieces of information can be learned from this discrepancy. First, local stakeholders are not in agreement that the crab fishery should be seen as a point of resilience, and second that the nonlocal stakeholders may have learned to characterize it as a resilience because of our reporting of the interview data to them. This example shows how categories for vulnerability and resilience, though not typically conflated, can be more fluid than we may realize. Diving into nonlocal categorizations of vulnerability and resilience has shown only minor differences with the overall DIMCP stakeholder cultural domain analysis. This is unsurprising since they comprise the majority of the group, but a useful check nonetheless.

Figure 11: Cultural Domain Analysis Results, Local Residents



Results derived from fifteen local residents for the cultural domain analysis (Figure 11) are also quite similar to the nonlocals. They show the same environmental vulnerability cluster, with the quadrant based organization of vulnerabilities on top, resiliencies on bottom, ecological on the left, and social on the right. Stress for the local is 0.100 after 23 iterations. This stress indicates that the local community's MDS plot is the best representation of fit with their data—almost in the excellent range. In this plot you can clearly see that 'crab fishery' is grouped with other social vulnerabilities. Local residents also have a divide, though a smaller one, separating vulnerabilities from resiliencies. There are two more very interesting attributes of the local resident cultural domain analysis plot that I would like to mention. First, while 'low-lying buildings' is an ecological vulnerability for both locals and nonlocals, it is more clearly associated with the cluster of ecological vulnerabilities for local residents. It is definitely not a social vulnerability for local residents, and so perhaps environmental vulnerabilities also incorporate structural or physical attributes. Interestingly, both locals and nonlocals clearly associated protected shorelines as ecological, but low-lying buildings were more distant from other ecological vulnerabilities for nonlocal stakeholders.

The second difference that I would like to highlight is the positioning of 'places nearby to go' which means 'places nearby to go in storms.' For local residents, this term is a clear ecological resilience. For nonlocal DIMCP stakeholders, however this item is a social resilience. Other than 'crab fishery' this is the only item to fully switch quadrants between locals and nonlocals. The sorting of 'places nearby to go' demonstrates that DIMCP stakeholders may have different emphases regarding

the same topic. In this case, local residents may be highlighting the protection this item provides from the storm while nonlocals are highlighting the beneficial social relationships that enable safe refuge. The way that local and nonlocal perspectives correlate with one another may seem unsurprising in this analysis, but without this additional and detailed look we would not know to what extent these two subgroups do correspond with one another.

Several key messages are apparent from this cultural domain analysis. First, there is a clear division between vulnerability and resilience seen in all three plots that indicates these categories are conceptually distinct for project stakeholders. This finding validates the use of vulnerability and resilience as meaningful conceptual categories across the stakeholder network. A second dimension of association between vulnerability and resilience terms is the continuum of social to ecological concerns. While this array is clearly less bifurcated for local residents, it is present. It is less well defined than the vulnerability and resilience divide, and this helps to demonstrate the way that ecological or environmental and social are fluid categories. The cultural domain analysis highlights ecological vulnerabilities as a well-defined cluster that may be the most easily understood and uncontroversial characterization that can be utilized for all of the vulnerability and resilience data. Overall, the stakeholder groups showed remarkable cohesiveness in opinion about the relationship of vulnerability and resilience terms. The primary exceptions to this of course are 'crab fishery' and 'places nearby to go.' As discussed above, the underlying reasons guiding how groups sorted these items differently are important and point to ways in

which perspective, value, and group collaboration relate to understanding of vulnerability and resilience.

Prioritizing Vulnerability and Resilience Concerns

Future realities of climate change are clearer for the Deal Island Peninsula area with understandings of vulnerability and resilience items presented in previous chapters. And, the relationship vulnerability and resilience to one another is clarified through the cultural domain analysis results. But, these analyses do not reveal what vulnerability and resilience items are most important to stakeholders. DIMPC stakeholder priorities for work towards reducing vulnerability and resilience were identified during a group structured interview activity, as described in Chapter 6[9]. Using the condensed vulnerability and resilience lists, twenty-seven participants helped to identify which terms should be priorities for the DIMCP stakeholder network to work on. These priorities reflect what DIMCP stakeholders imagine are the abilities of the DIMCP to effect change in addition to indicating value and importance amongst the vulnerability and resilience items. Below, I present the prioritizations for vulnerability and resilience. Then, I shift focus to highlight important caveats for these prioritizations based on insights from local residents. Prioritization data construct a clearer picture of what stakeholders believe future priorities should be and also help to refine previous understanding of vulnerability and resilience.

[9] As a reminder, the full list of structured interview questions can be found as Appendix I.

Vulnerability Priorities

As presented in previous chapters, DIMCP stakeholders have well developed views regarding multiple vulnerabilities faced in the Deal Island Peninsula area due to climate change. Though the salience of these vulnerabilities varies across the network with particular stakeholders, DIMCP project leaders identified a need to more clearly identify which vulnerabilities the full network felt important to address. Therefore we gathered responses to the question: "What should be the network's top priority for vulnerability?" through a structured interview activity. Table 10 shows both the options available for selection and the choices selected by DIMCP stakeholder participants. The vulnerabilities chosen to be the top priorities for the DIMCP are: 'deny vulnerability,' 'rising sea levels/ rising tides,' 'erosion,' 'distant management and governance,' and 'storms.' These five items were identified as the top network priorities due to a tie for both first and third place (see Table 10).

Table 10: Vulnerability Priorities for DIMCP Stakeholder Network

Options for Vulnerability Priorities	**Selected Top Three Priorities**
changing demographics	
deny vulnerability	1st place (tie)
distant management and governance	3rd place (tie)
erosion	2nd place
isolation	
low lying buildings	
rising sea levels and rising tides	1st place (tie)
salt water intrusion	
storms	3rd place (tie)
weak economics	

These selections incorporate both social and ecological vulnerabilities and position expected impacts such as 'rising waters,' 'erosion,' and 'storms' alongside social and political features more unique to the Deal Island Peninsula area such as 'deny vulnerability' and 'distant management and governance.' These designations indicate DIMCP stakeholder network preferences span the social-ecological system.

In first place, two items tied with an equal number of votes: 'deny vulnerability' and 'rising sea levels/ rising tides.' Rising waters is an obvious choice within the context of this low-lying area but 'deny vulnerability' requires additional explanation. It communicates the idea that local residents do not accept or fully understand the vulnerability they face through threats from climate change (DIMCP Interviews 2014). This item will be discussed in more detail later in this chapter. The prioritization given to 'deny vulnerability' and 'rising sea levels/rising tides' emphasizes the stakeholders want to work on physical and ecological coping as well as building knowledge within the local community.

The second placed vulnerability priority was identified is 'erosion.' As described earlier in Chapters 7 and 9, erosion relates to receding and disappearing shorelines. And in third place, 'distant management and governance' and 'storms' are also tied. Distant management and governance was discussed in Chapter 9, while 'storms' emphasizes weather events that produce excessive rain, wind, waves, and erosion. Overall, these choices for vulnerability priorities are not surprising based on earlier ethnographic contextualization of vulnerability data. Items not selected as top priorities include 'low-lying buildings,' 'isolation,' and 'salt-water intrusion,' and are all more minor concerns compared to the selected priorities. Other items, including

‘changing demographics’ and ‘weak economics’ are important concerns within the area. The fact that they were not selected in this prioritization activity may mean that DIMCP stakeholders do not see many ways in which the network can assist with these problems.

The vulnerability priorities designate what DIMCP stakeholders as a whole identify possibilities for future work to build climate change resilience. The selections indicate a high priority for ecological concerns: sea level rise, erosion, and storms. But the selections also communicate that stakeholders see an important role in cross-system cooperation and communication to reduce social vulnerability and address ecological concerns. In selecting ‘deny vulnerability’ and ‘distant management and governance’ the DIMCP stakeholder network is indicating a need and preference for tackling perhaps the two most difficult social issues related to climate change vulnerability. Work to build knowledge and understanding among local community members as well as non-local’s understanding of existing resilience, and to enhance relationships between residents and environmental management are needed but difficult and complex projects. The DIMCP functions as a link between the local community members and outside agencies and the network’s support of ‘distant management and governance’ suggests that there is hope that this type of work can be successful. The DIMCP network identified priorities help focus efforts on the environmental threats the communities face, but also demonstrate a support for the cooperative and collaborative work that the DIMCP has prioritized.

Resilience Priorities

Just as with the vulnerability priorities, the identified resilience priorities emphasize what is relevant for the work of the DIMCP stakeholder network. The interview question asked to elicit this information is: "Which resilience feature is most important for the work of the network?" Table 11 shows the options (only a subset of resiliencies provided by our facilitator Dr. Feurt) and selections for this question. For the resilience prioritization data, the highest ranked answers(s) were removed and only two rounds of questions were recorded, with repeated questioning for the remaining terms. The first round tied with equal respondents voting for each term, giving a total of three resilience priorities. These are: 'adaptability to change,' 'ethic of cooperation' and 'protected shorelines' (see Table 11). As a reminder, 'adaptability to change' and 'ethic of cooperation' were discussed as attributes of local residents in Chapter 8. 'Protected shorelines' was also discussed in this chapter and can include either bulk-headed land or living shorelines that are more adaptable.

Table 11: Resilience Priorities for DIMCP Stakeholder Network

Options for Resilience Priorities	Selected Top Two Priorities
adaptability to change	1st place (tie)
can handle low flooding	
crab fishery	
ethic of cooperation	1st place (tie)
places nearby to go in storms	
protected shorelines	2nd place
protection provided by marsh	
self-reliance	
steadiness of environment	
strong attachment to place	

The selection of 'adaptability to change' and 'ethic of cooperation' as the primary resilience concerns could mean two things. First, DIMCP stakeholders could appreciate the 'adaptability to change' and 'ethic of cooperation' inherent in local community members (as discussed in Chapter 8) and seek to enhance and support this existing resilience. Or, these resiliencies could have been translated onto the DIMCP stakeholder network, and instead (or in addition) mean that DIMCP stakeholders value developments in knowledge and understanding of climate change threats and vulnerabilities across the network through DIMCP activities and want them to be continued into the future. Regardless of which explaination stakeholders were using, 'adaptability to change' is important as the environment and communities change dramatically within the next thirty to fifty years. Local community members may find themselves flooded out of their homes, or eventually weighing the option of government buy-out for their properties. Individual homeowners will have important decisions to make as will the community at large in terms of its support for one another.

The final resilience, protected shorelines, is one of the most immediate forms of resilience that many Deal Island Peninsula area residents have that protect from impacts of sea level rise, erosion, and even to a certain extent, storms. Due to the low-lying nature of the area and uncertainty of emergent changes, the type of protections that will be successful into the future is still largely unknown.

The DIMCP stakeholder network priorities for resilience indicate that social resiliencies are prioritized above the physical and ecological ones. 'Adaptability to change' and 'ethic of cooperation' are two incredibly important attributes of

resilience that will assist Deal Island Peninsula area stakeholders in planning for and adapting to future climate change impacts. This prioritization of the social resiliencies over the physical or ecological ones helps to indicate that stakeholders see a primary need to continue building these resiliencies into the future. And, while the protection of shorelines was also a priority, its secondary position encourages the DIMCP's emphasis on cooperative planning for the future. The vulnerability and resilience priorities described above are the products of DIMCP stakeholder selection of items through a structured interview process. These choices were identified through data gathered from twenty-seven DIMCP stakeholders and are a good proxy for social-ecological system-wide prioritizations.

Local Perspectives on Vulnerability and Resilience Prioritization

The system-wide prioritizations of vulnerability and resilience are important to ensure that the activities and emphases of the DIMCP correlate with the network's preferences. However, since identification of vulnerabilities and resiliencies varies so much between locals and nonlocals, I felt it important to look more closely at these data to see if local resident's preferences contradict or change understanding of the group's prioritized items. There are two key points stemming from this analysis that warrant special attention. The first is contestation regarding the meaning of one of the vulnerability items, and the second are the slightly different prioritizations that locals gave to vulnerability and resilience priorities.

During the course of the DIMCP there has been very little open disagreement or contestation. During workshops and project activities people have been very collegial and open to learning about other's perspectives. One item that did surface as

a point of contention, however, was the designation of 'deny vulnerability' as a DIMCP stakeholder network priority. Findings from the DIMCP Stakeholder Interviews (2014) reinforced views among project stakeholders that local community members do not accept their own vulnerability and have not done much to mitigate impacts of environmental changes. Echoing the thoughts of several DIMCP stakeholders, one interviewee said: "I mean, all of these waterfront—or these water communities are really vulnerable and they have to accept that" (DIMCP Interviews 2014). Underlying this statement is the logic that because the communities seem to be operating as normal, they are denying the potential for future climate change impacts.

And yet, many local residents argued that they do understand and respond to threats where appropriate. During a discussion following the structured interview activity that led to these vulnerability prioritizations, local residents were vocal in defending both their understanding and acceptance of vulnerability (DIMCP Workshop February 2015). One resident, a waterman, gave a vivid example. During a recent storm event, the area around and within his workshop flooded. A freezer storing his supply of soft shell crabs was compromised by water and he faced a total loss of his valuable and hard-earned product collected throughout the crabbing season. Luckily, he was able to purchase another freezer and move the crabs in time. The waterman told his story to the other participants at the DIMCP to make a point: he was not unknowledgeable or in denial about the threat of flooding. The watermen argued that he like others in the community know that flooding is a possibility. But, because he, his family, friends, and neighbors had never before experienced flooding in that particular location he had not considered the freezer a liability. The watermen

emphasized that for locals understanding of threat comes from experience and local knowledge, not from outside knowledge or generalized projections (DIMCP Workshop February 2015). This event has changed the way that this local resident prepares for storms and thinks about the threat of flooding to his particular property. He argued that specific and practical knowledge such as this that local people need in order to better prepare for new threats that they have not experienced or heard of from their families or fellow community members.

This issue of denying vulnerability is a particularly important one with regard to discussions of climate change adaptation. The story above about the soft shell crab freezer gives some indication about why those from outside the community might think that locals are denying their own vulnerability. After all, most non-coastal people do not have to worry about their homes or properties flooding. The underlying logic applied by nonlocals is that by being potentially subject to vulnerability you are knowingly placing yourself in a vulnerable position. And, if you have knowingly remained in the vulnerable place you must be denying that it is vulnerable. Whereas, for local Deal Island Peninsula residents, the continued ability to make a living in a coastal area is dependent on their ability to weather periodic storms and flooding—it is a normal part of life. And, as the local waterman stressed it was completely logical and in line with his past experience for him not to expect a flood that would destroy his freezer. This exploration of the vulnerability 'deny vulnerability' theme has uncovered a rich area of disagreement between local and nonlocal stakeholders related to experiential knowledge. Differences in perspective such as these, due to

positioning within the social-ecological system, requires further thought and reflection moving forward.

The second issue I wanted to mention is related to local resident perspectives of vulnerability and resilience are the different priorities that local residents chose when compared to the DIMCP stakeholder network. Table 12 shows the local priorities compared to the overall priorities of the DIMCP stakeholder network. Whereas the findings shown in Table 10 and Table 11 (the vulnerability and resilience priorities of the full stakeholder network) are the result of twenty-seven DIMCP stakeholder responses to structured interview questions, the results in Table 12 were derived from only the responses of ten local residents who were present at the workshop. Despite a small sample size, I find it important to contrast the results of this subgroup to the overall network to ensure that local resident opinions do not significantly differ from the group's responses.

Table 12: Comparison of Network and Local Vulnerability and Resilience Priorities

	Network Priorities	**Local Priorities**
Vulnerabilities		
1st Place:	deny vulnerability	erosion
	rising sea levels/ rising tides	
2nd Place:	erosion	deny vulnerability
3rd Place:	distant management and governance	distant management and governance
	storms	rising sea levels/ rising tides
		isolation
Resiliencies		
1st Place:	adaptability to change	adaptability to change
	ethic of cooperation	
2nd Place:	protected shorelines	protected shorelines

As reported in Table 12, the choices that local residents alone made to prioritize vulnerabilities and resiliencies for action are similar to the full DIMCP network. There are a few differences in prioritization, with local residents choosing 'erosion' over both 'deny vulnerability' and 'rising sea levels/ rising tides' for their 1st place choice for vulnerability. This choice probably reflects residents' understanding of erosion as a more immediate reality than sea level change, and also something that if addressed can help protect against sea level rise. In addition, the question posed did relate to what the DIMCP stakeholder network could work on and local residents may see more possibilities for work towards preventing erosion than rising seas and tides.

Interestingly, local residents themselves also chose 'deny vulnerability' as the second placed vulnerability concern, despite the fact that local residents were vocal at the February 2015 workshop about their understanding of potential future threat (as discussed in the previous section). This may show that though they believe community understanding of vulnerability exists that it could be improved. In fact, during many workshops and social interactions, local residents mentioned the importance of involving local community members who did not care about environmental change and resilience issues. These community members may feel that nothing will happen in their lifetimes and are characterized as having "their heads in the sand" by local stakeholders involved in the DIMCP (local stakeholder, personal communication 2016).

Local residents chose 'adaptability to change' and 'protected shorelines' as resilience priorities, but locals did not select 'ethic of cooperation' as either a 1st or

2nd place priority. Again, it is somewhat unclear whether local residents would have interpreted 'ethic of cooperation' to mean the cooperation between local residents, between local residents and outsiders, or among the DIMCP stakeholder network. Regardless, however, local residents prioritize 'adaptability to change' above an 'ethic of cooperation' possibly indicating that they favor more tangible resilience features than does the DIMCP stakeholder network in general. The focus on immediate and tangible vulnerability and resilience items is an important and notable difference in the priorities of local residents. But overall, the differences in local versus network prioritizations are very similar. Only the issue of 'denying vulnerability' seems to require further exploration.

In summary, the prioritization of vulnerability and resilience items for action by the DIMCP stakeholder network are an important addition to understanding climate change impacts to the Deal Island Peninsula area. This analysis should be seen as a guideline for understanding the DIMCP stakeholder network objectives, both in terms of value and importance, and as they are related to imagined possibilities for the future. Prioritizations for vulnerabilities and resiliencies demonstrate nearly equal support for both ecological and social factors, meaning that both are very important to the network and local residents and support work spanning the social-ecological system. For vulnerabilities, expected physical threats are included alongside more complex social realities specific to the Deal Island Peninsula area. The lack of inclusion of demographic and economic concerns should be noted—had they been included in the potential choices for respondents the answers may have been different.

For the resiliencies, social resilience is prioritized over the ecological factors for resilience. The social complexities of the Deal Island Peninsula area pose unique problems that must be addressed in a cooperative manner. The selections of priorities such as 'distant management and governance' and 'deny vulnerability' by the DIMCP network seems to lend support to DIMCP interests in continuing these initiatives. As contestation and complication regarding the issue of 'deny vulnerability' shows, however, there is more work to be done in clearly delineating what it would mean to work on these vulnerabilities and resiliencies.

Conclusions

These data have fully explored the scope, relationship, and prioritization of vulnerability and resilience for the Deal Island Peninsula area. A complete view such as this across the social-ecological system is important for two primary reasons. First, it emphasizes a holistic picture incorporating both vulnerabilities and resiliencies across geographic space and socio-political scales. This enables more equal footing for ecological and social concerns, and helps to highlight those issues that do not easily fall into one of these categories. For the Deal Island Peninsula area, this is a new and unique way to conceptualize the problems and issues that are occurring. The comprehensive listing of vulnerabilities and resiliencies across the DIMCP stakeholder network reflects a vast diversity of opinions that are only well understood after a complete read of Chapters 7 through 10.

And secondly, this analysis is important because a systems-level view is neither local nor nonlocal. Instead, it is a useful touchstone requiring both perspectives and a tool of engaged research and effort. The cultural domain analysis

allowed a more detailed view of the way in which vulnerability and resilience are conceptualized by the full stakeholder network and also provided validation that local residents' views are not being misrepresented or subsumed by other interests. In addition, the prioritization analysis showed remarkable consistency among local and nonlocal views and supports continued efforts by the DIMCP to work collaboratively. A systems level understanding of vulnerability and resilience is important for formal assessment of resilience and vulnerability to climate change as well as to inform engaged work of the DIMCP to build resilience and reduce vulnerability.

Chapter 11: Conclusion

The purpose of this dissertation is to define resilience to climate change for the Deal Island Peninsula area from an ethnographic perspective. Using engaged anthropology and working from within the DIMCP, I have been able to explore what vulnerability and resilience mean not only for DIMCP stakeholders, but also for the local residents and nonlocals for whom building resilience to climate change for the area is a concern. My struggle has been to develop a clear way to write about vulnerability and resilience together, and ethnographically across scale. In this chapter I will present a summary of the dissertation and a closer look at the results of this ethnographic analysis of vulnerability and resilience.

Summary of the Dissertation

The Deal Island Peninsula area requires rich contextualization in order to adequately represent the historical, environmental, social, and cultural complexities of the experience of climate change. I have developed this dissertation in a non-traditional format for two reasons. The first is to showcase mechanisms of engagement, theory, and research methodologies in a dual role: as both informing my work and also influenced by realities of the Deal Island Peninsula area as case study. And the second is to develop a closer ethnographic view of DIMCP stakeholders, and particularly locals and nonlocals on their own in Chapters 7 through 10. These chapters discuss vulnerability, resilience, climate change, and the DIMCP stakeholder network from a perspective that requires previous knowledge and context provided by the dissertation's earlier chapters.

Chapter 1 introduces multiple topics covered in the dissertation and provides a sense of their organization and usefulness to one another. In Chapter 2, I began with a brief history of the Deal Island Peninsula area to highlight themes within the area's past relevant to current day culture, community composition, economics, and relationship with the environment. These key themes relate to the longstanding relationship that local people have with the environment and community in the Deal Island Peninsula area. Chapter 3 describes climate change as a global phenomenon and discusses the magnitude of the problem for the Chesapeake region, giving some insight on mechanisms for environmental governance as well as local community member perspectives of climate change. And, Chapter 4 provided considerable insight into the development, functioning, and objectives of the DIMCP and the ways in which stakeholders have been interacting with and working alongside one another. It also develops engaged environmental anthropology as a key influence on the scope and purpose of this research. These chapters provided key background knowledge to prepare the reader for a more informed reading of the theory, method, and substantive chapters of the dissertation.

Chapters 5 and 6 highlighted key features of theory and method relevant to my work. Key areas of theoretical coverage were: anthropology of climate change, social-ecological systems, and resilience. This work sits at the interface between these three theoretical perspectives. It is grounded in a social-ecological systems perspective but employs key teachings from climate change anthropology to explore resilience in a new way. By combining insights from a number of resilience literatures, my work is best described as melding social-ecological resilience and

community resilience work and does not fit squarely within any one body of resilience literature. The Deal Island Peninsula area is unique in having none of the formal government structures or pre-existing institutions that would typically be emphasized in this type of work. I therefore needed to construct a new way to look at the people and knowledge of the area. Chapter 6 describes multi-sited ethnography as an organizing principle for participant observation, semi-structured and structured interviewing, and cultural domain analysis, all of which are familiar methods in anthropology. The methods themselves are not novel but the way in which they were applied to develop a representative body across the social-ecological system is unique. In this way theory and method have both informed my work and been shaped by the particular realities inherent in this case.

Chapters 7 through 10 provide the bulk of data for the dissertation and emphasize understanding of vulnerability and resilience to climate change ranging from the local level to the full DIMCP stakeholder network. Chapter 7 focused on local insights on vulnerability. Vulnerabilities identified here were: low-lying, sea level rise, land sinking, rising water table, erosion, disappearance of rich fisheries, changes in weather, and changes in community composition. Key messages from this chapter were that these vulnerabilities should be seen not as the effects from climate change but those things that will negatively impact effects from climate change. In addition, each of these is an ongoing and experienced reality rather than a future threat. The experiences of these vulnerabilities reveal a changing relationship of local Deal Island Peninsula residents to their environment. Local residents also stressed that many environmental problems are human caused, rather than just "natural."

Despite this understanding of human agency as a root cause of many problems, Deal Island Peninsula area residents have a practical view that sometimes you just have to accept and accommodate the realities you face.

Chapter 8 discussed local ethnographic insight on resilience. The resiliencies identified through the perspectives of local residents include: marsh and marsh grass, protected shorelines, blue crab fishery, ability to handle flooding and storms, faith and closeness to nature, independence and resourcefulness, social networks and community, and resilience as a state of mind. The resiliencies are surprisingly localized and depend on specific contexts within the Deal Island Peninsula area that may not be recognizable to an outsider. For example, some locals see bulk-headed shorelines as resilient while the commonly held public view is that living shorelines provide resilience. Local residents see themselves as having a strong stewardship role in relation to their environment. They also highlighted significant experience and knowledge in adapting to their local environment. And, cooperation amongst community members was an important feature of resilience. All of these lead to the conclusion that resilience is a way of life and cultural value for Deal Island Peninsula area residents.

The next chapter, Chapter 9, describes additional perspectives from nonlocal sources that help to enhance the picture of vulnerability and resilience. This insight comes both from external scientific knowledge and other types of knowledge held by nonlocal stakeholders. Items receiving significant attention in this chapter include: demographics, economic instability, shoreline erosion, land subsidence, marsh degradation, flooding, environmental governance, and facing challenges together.

Key messages from this chapter include: scientific data can enhance our understanding of ethnographically defined vulnerability and resilience, nonlocal stakeholders highlight different concerns than local residents, and that nonlocals provided only one significant addition to items of resilience identified by local residents. The data described in this chapter enhance the view provided by Chapters 7 and 8 that were presented in a very specific manner grounded in the local perspective. Chapter 9 helps us to see additional and alternative viewpoints that direct our attention to differences in the way that vulnerability and resilience are characterized across the social-ecological system.

Chapter 10 refocuses on the idea of conceptualizing the Deal Island Peninsula area as a social-ecological system in order to expand our consideration of vulnerability and resilience to climate change. Instead of only discussing what vulnerability and resilience are across the system, Chapter 10 also incorporates inquiry into what the relationship between vulnerability and resilience are, and how DIMCP stakeholders prioritize their interests in working on vulnerability and resilience items. Viewing the problem of climate change across the Deal Island Peninsula area emphasizes a holistic viewpoint that incorporates multiple perspectives. In this case, the cultural domain analysis demonstrates that there are only minor differences in the way in which local and nonlocal stakeholders comprising the DIMCP stakeholder network understand vulnerability and resilience. The analysis also validated vulnerability and resilience as key conceptual categories and highlighted a social-environmental spectrum as important to cognitive organization. In the chapter's final section, prioritization of resilience and

vulnerability items for work by the network revealed a desire to work on both ecological and social items as well as closely associated prioritization between locals and nonlocals. Allowing diverse perspectives to be combined and considered together in this way enables a unique view of data and perspectives that otherwise would not exist but are important in the future for developing effective and collaborative adaptation planning.

Results of Analysis

This dissertation has explored understandings of vulnerability and resilience to climate change as well as the relationship of these terms to each other and prioritization of vulnerability and resilience items for action by the DIMCP stakeholder network. Ethnographic discussion of local residents' perspectives were used to anchor the initial discussion of vulnerability and resilience in Chapters 7 and 8 in order to provide a situated and ethnographic look at how vulnerability and resilience are experienced in the Deal Island Peninsula area. Then additional information from both nonlocals and from the larger stakeholder network was added to further contextualize these key concepts in Chapters 9 and 10. A key result of this analysis is that vulnerability and resilience items represent the full social-ecological system, not only one or the other. Stakeholder emphasis on social, cultural, economic, and political concerns helps to place them on equal footing with the ecological and environmental concerns traditionally associated with climate change impacts such as sea level rise and flooding. Social factors such as demographics, faith, and strong attachment to place direct our attention to important social contexts of resident's experience. Therefore, a second result is that emphasis must be placed on

vulnerability and resilience as present realities in addition to future conditions. In this section I would like to provide some additional summary and concluding thoughts related more specifically to the topics of vulnerability, resilience, and the ethnographic approach.

Vulnerability

Although the focus of this dissertation research is in resilience to climate change, vulnerability became an integral concept in discussions to understand both strengths and weaknesses regarding anticipated impacts of climate change. I included vulnerability as a topic of conversation in my semi-structured interviews to gather a better sense of what people understood to be their susceptibility to environmental and social future change. Within the academic literature vulnerability is a complex concept and refers to a state of being, a consequence of perturbation, or a cause of negative impacts as described in Chapter 7. It is a dynamic construct that we use to describe human relationships to the environment and the environment's relationship to human needs (Oliver-Smith 2009). However, vulnerability is also a common sense term that DIMCP stakeholders were easily able to identify and discuss with regard to the Deal Island Peninsula area (Appendix D).

As described in Chapter 3, climate change is often seen as a global phenomenon that has similar (though not uniform) effects across the world in terms of sea level rise and increasing temperatures. But identification of vulnerabilities by local stakeholders showed a clear preference for items derived from personal and cultural knowledge and experience rather than large-scale projections. This occurred at several workshops where knowledge of the past was used to inform projections for

localized impacts from future storm events. By evoking memories of water levels or damage during previous storms and flooding, residents helped to establish estimates of threat and future vulnerability. Local residents were particularly sensitive to highlighting complex and interacting variables. During Hurricane Sandy the wind direction propelled water towards Crisfield and prevented its dispersal, contributing to high floodwaters and trapping it until the tides changed (DIMCP Interviews 2014). This exemplifies the type of dynamics and specialized knowledge required to truly define local vulnerability.

For nonlocal DIMCP stakeholders, what constitutes vulnerability is informed by concern for the local community, but with an emphasis toward restoration and conservation of the natural environment. They value the natural system itself for its dynamic and ecological processes. The Deal Island Peninsula area's marshes and unique coastal environment is seen as worth preserving in its own right, outside of its function as habitat and resource for local residents. This quote from a nonlocal gives some insight on this perspective:

> But, to me, it's still a much more natural system, it still hasn't been destroyed, but it's very vulnerable. And I think because it is still a very natural system, compared to what we've done in other parts of the Bay, it's real important to let these communities know that, you know, you've really got something great here. It's worth protecting, not just because you're earning a living off of it, but because it has its own inherent value for us and for your children and your grandchildren, if mankind lasts that long. (DIMCP Interviews 2014)

This DIMCP stakeholder is reiterating that the environment, itself, removed from any particular cultural association or fondness that local residents have for it, is an important element to preserve and protect from future climate change impacts. This

understanding contributes to the way in which vulnerabilities are defined and prioritized.

Many of the vulnerabilities brought up feelings of sadness or anger for local community members, particularly in instances of change seen as driven by outside human influence more than natural environmental processes. For example, with land sinking due in part to marsh mismanagement, or through the livelihoods of watermen being undermined by increased regulation. These relationships are not simple cause and effect reactions. They are highly influenced by human relationships and interactions. Fishing regulations have, for example, helped to sustain the fishery. Complex knowledge such as this translates also to threats from climate change. Though predicted effects will be experienced we must also ask: What are the added effects from human influences that will determine the ways in which the ultimate impacts of climate change will be felt among the communities?

For local residents vulnerability to climate change has to do with contexts of their lives such as economic, family conditions, changing composition of their communities, as well as a changing and disappearing landscape. Many local stakeholders are far more focused on these immediate vulnerabilities rather than conceptually distant future change like "climate change." For instance, changing community dynamics that have caused people's children to move away may be more important to them than the fact than yet-to-be-experienced environmental changes. The vulnerabilities related to changing community composition and a declining economy, in particular, are meaningful to local residents.

Nonlocal DIMCP stakeholders highlighted vulnerabilities such as marsh degradation, flooding, isolation, salt-water intrusion, and style of development. These topics are important to the Deal Island Peninsula area, but local stakeholders did not see them as vulnerabilities. The understanding that flooding and marsh degradation are not vulnerabilities in the minds of local residents is significant. This is partially due to the nonlocal's emphasis on the natural environment and local emphasis on more immediate vulnerabilities, but could also be due to another factor. Local residents interact and expect certain events whether due to natural processes (e.g., high tides) or because of human caused degradation to the environment (e.g. the sinking marshes due to OMWM). They are regular occurrences over which they have no control and can be seen as a normal part of life, rather than a vulnerability.

Regardless, the vulnerabilities described on behalf of local residents in Chapter 7 and through nonlocal perspectives in Chapter 9 produce a picture of overwhelming vulnerability for the Deal Island Peninsula area. The physical positioning of the land itself and ongoing ecological factors of change such as marsh degradation and erosion mean that changes more traditionally associated with climate change such as sea level rise and flooding will have an even greater effect. It is not only the environmental and ecological vulnerability that local communities face but also social ones in terms of changes in economy, community composition, and lack of relationships to support shared environmental governance.

Analysis of this information tends to lead to the conclusion that multiple trajectories of long-term change will soon coincide with insurmountable environmental impacts via climate change. And this is to a great extent true. The Deal

Island Peninsula area's population will continue to decline as periodic and/or permanent flooding claims marshes and low-lying lands. Area residents know this and describe their predicament well through their identification of vulnerability items. For many local residents, a primary concern is in maintaining their landscape, homes, and communities into the future and protecting them from threats such as sea erosion, economic decline, and sea level rise. Their ability to remain in place is integral to the sustainability of their communities into the future. Many understand that the low-lying nature of the Deal Island Peninsula area means that the future will be far less like the past than has been expected through the generations. This is why focus on resilience within the Deal Island Peninsula area is important and necessary for work related to climate change.

Resilience

Resilience is a complex topic utilized in a variety of disciplines as described in Chapter 5. My interest in this dissertation was to better understand the meaning of resilience to climate change among DIMCP stakeholders. Therefore, I have drawn together resilience theory from work in social-ecological systems, psychology, applied settings, and critical insights from geography and political ecology to help define resilience both as a property of the system, system components, and people in the Deal Island Peninsula area related to adaptive capacity. Some definitions of resilience position it as the ability of a system to maintain its identity and state of being—meaning that it can be either positive or maladaptive and negative (Walker and Salt 2012). For DIMCP stakeholders however, resilience is an overwhelmingly positive system attribute. Some local residents did see a lack or absence of resilience

as mentioned in Chapter 8, but resiliencies identified were primarily positive. Resiliencies identified by network stakeholders (Appendix E) include both ecological and social features of the social-ecological system. An ethnographically contextualized presentation of these resiliencies was provided in Chapter 8 and highlights the unique perspectives of local residents related to resilience for their area.

Whereas vulnerabilities were easily identifiable for both local and nonlocal DIMCP stakeholders, the resiliencies inherent in the area were far more apparent to local residents. Nonlocal stakeholders' significant contributions to resilience include only the item 'face challenges together' to the listing of resiliencies (as described in Chapter 9). The added resilience, 'face challenges together' describes a new connection with outside individuals and entities and is a unique and slow-going process. For local residents, resilient features of the Deal Island Peninsula social-ecological system are community-specific. These resiliencies are a part of their way of life and experience living in the area.

Our understanding of resilience for the Deal Island Peninsula area can be understood to be highly specific to local contexts—the result of the community's character and realities. Numerous quotes demonstrate the meaningful relationship people have with their rural and peaceful setting. Locals identify many important resiliencies in their landscape and communities such as 'faith and closeness to nature' and 'social networks and community' that help them to cope with changing environmental and social conditions. These resiliencies are being shared with come-heres as they become embed themselves within the local community.

The resilience that exists in the local community is related to the closeness that residents have with nature and the relationship that they have built over time to accommodate various threats such as storms and changes in the physical and economic structures of the area. Long-time locals are knowledgeable about what makes them resilient to these types of threats (e.g. Hurricane Sandy). They know how to prepare their homes and businesses for impact, who to contact for help and where to go to get out of the way of a storm. Resilience can be seen as built into the community's coexistence with the environment and their way of life.

There is continuity in the way that Deal Island Peninsula area communities have been resilient over time. The resiliencies have aided their ability to adapt to changing environmental and social conditions through history. For many residents who are not come-heres this relationship is also historic—extending back through the generations. Resiliencies have developed alongside experience living in the area and are seen in their 'ability to handle flooding and storms,' work with the 'blue crab fishery,' and maintain a 'resilience state of mind.' For local residents, resilience to climate change is the character, strengths, skills, and persistent features of the environment that help them to endure in a changing culture and landscape.

In addition to the traditional resilience of the community, newer resilience is developing through new ways to 'face challenges together.' The Deal Island Marsh and Community Project is the perfect example of this. During my semi-structured interviews with DIMCP stakeholders I asked if anything was being done right now to build resilience for the future. Many people mentioned the project and the work that was happening through the collaborative learning and research activities. One local

resident said: “Your study. At least somebody’s interested in it. I didn’t think nobody was even paying attention to it (environmental changes in the area)." When I first heard this response I thought people were just being nice in saying that they felt the project was going to do some good. What I have realized since is that through its very existence the project is providing resilience to the Deal Island Peninsula area—regardless of the fact that we have yet to implement any specific climate change planning activities. What the project accomplishes is creating new relationships between individuals and organizations, sharing knowledge and information across traditional divides, and perhaps most importantly in demonstrating interest in and concern for what happens to the Deal Island Peninsula area and its residents. In this way, the project is building resilience and reducing vulnerability.

The concept of resilience has been very important to the work of the DIMCP, but I argue that it is not useful because it is plentiful and popular in contemporary discourse. Instead, it is a meaningful category in its own right to people within the Deal Island Peninsula area. Resilience is complex and takes many forms within the diverse perspectives across this social-ecological system. It is a much more dynamic category than vulnerability and depends upon context and interpretation such as that provided through the ethnographic perspective. Resilience is the positive antidote to vulnerability’s negativity and is an important starting point for optimistic climate change adaptation planning and strategies to improve and strengthen the community’s ability to maintain their way of life as long as they are feasibly able.

Ethnographic Approach

There are a few additional insights that I wanted to include as a result of my reflection on this project of engaged environmental anthropology of climate change: First, I have found it very useful to consider both vulnerability and resilience simultaneously. In defining both of these we have a much better understanding of the complete picture of the realities faced by DIMCP stakeholders with regard to climate change. In addition, as I talked with people in the DIMCP I was able to discuss both negative and positive aspects of their experience. I fear that if I had discussed only vulnerabilities, many important resiliencies would have gone unnoticed.

Second, it is apparent through this analysis that there are many diverse perspectives held side-by-side within the DIMCP stakeholder network. Individuals, the small communities, and different DIMCP stakeholder groups each brought different insights. The diversity of opinions meant that participating individuals made a commitment to open-minded sharing and listening during DIMCP activities. Despite diversity of opinions, people felt positively about moving forward together indicating that full agreement may be unnecessary to proceed. The collaborative learning approach (described in Chapter 4) was the basis for this achievement.

Third, the construction of the systems-level view of vulnerability serves multiple purposes. Environmental and community dynamics of the Deal Island Peninsula area are constantly changing. As locals have made clear, changing dynamics have been an important part of the community's ability to survive and thrive over the past century, and continue to be today. Understanding vulnerability and resilience to climate change for the Deal Island Peninsula area requires both a

system-wide view as well as a detailed look at particular components within the system. Yet the social-ecological system should still be understood as a tool (as highlighted before by Crane 2010), and one that needs to be monitored and updated periodically to ensure it accurately reflects changing dynamics.

Considering vulnerability and resilience together, holding diverse perspectives in concert with one another, and using the social-ecological system as a tool are each important contributions this work makes. These insights for conducting ethnographic research related to resilience to climate change point to the many ways in which anthropology's emphasis on holism remains pertinent in our increasingly complex world. This investigation of vulnerability and resilience to climate change has produced multiple insights that are highlighted in this chapter. For reference and reminder, these key points are also included below in bulleted form as Appendix J.

This dissertation demonstrates that diverse and rich perspectives related to vulnerability and resilience seem to be working well in interaction with one another. Being cognizant of the ways in which we are using and skillfully interlinking them is important. The future success of the DIMCP depends on our ability to continue building resilience while reducing vulnerability. This dissertation demonstrates just how much resilience is based in the local community, and in human relationships and interactions that we must maintain with one another. Engaged anthropology plays a key role in ensuring this work continues successfully into the future.

Implications for Applied Work

There are several implications this work has for efforts to build resilience to climate change in local communities. First, we must be cognizant of the context and

role that projects such as the DIMCP play in relation to global and regional adaptation planning activities. Many times, climate change adaptation options are orchestrated from the top-down through governmental agencies. Our project is different and unique in that it positions academics, environmental and governmental managers and local community members into processes and learning relationships with one another. In this way, the Project has facilitated generalized resilience building by supporting work that can lead to shared planning and decision making activities, rather than overt environmental governance for climate change adaptation.

Second, while much climate change adaptation work is being done in large coastal cities and towns, communities like this are being left out due to their isolation and self-sufficiency. The Deal Island Peninsula area is a small, sparsely populated rural settlement lacking both formal governance structures at the local level as well as excess financial resources. Investigation of vulnerability and resilience helps to provide a template for work in other places (both urban and rural) to highlight a more ethnographic understanding from inhabitants and citizens. Such insights are relevant in all cases of climate change adaptation planning, but will be especially important in areas where there are few programmatic resources to aid local communities. We should help to ensure that these marginalized communities are not forgotten and left to fend for themselves.

Third, there are several practices I have employed in field work and writing this dissertation that will be useful to guide work in understanding local and place-specific investigation of vulnerability and resilience to climate change. First, I have emphasized attention to features across the social-ecological system and have

attempted to highlight both environmental as well as cultural factors in understanding strengths and weaknesses in the face of climate change. While my focus on cultural knowledge and ethnographic information has helped to highlight social features of vulnerability and resilience, this has not been to exclusion of environmental features of vulnerability and resilience. In fact, there are some very interesting results related to environmental vulnerabilities that this dissertation highlights. The cultural domain analysis activity showed that environmental vulnerabilities were the most easily grouped and cohesively identified across the stakeholder network. And yet, through ethnographic exploration of the data we can see that there are considerable differences in the ways that locals and nonlocals define environmental vulnerabilities (e.g., land sinking as a disheartening experienced reality vs. land subsidence as a distant and uncertain regional process). In addition, our understanding of social vulnerabilities (such as "deny vulnerability") has implications for how we acknowledge and deal with environmental vulnerabilities. The understanding that there is variability in the way that locals think about the threats and risk of climate change is incredibly important for adaptation planning activities and means that there must be a diversity of ways in which we approach these topics with the local communities into the future.

In developing an ethnographic view, I have prioritized the experiences and insights of individuals to inform coverage of climate change vulnerability and resilience. The data gathered and presented here reflects understanding from across the DIMCP stakeholder network, but especially highlights the local perspective. This local perspective points to the conclusion that cultural, personal, and experiential

knowledge play a significant role in the way that vulnerability and resilience to climate change is understood. For local residents history, heritage, and experience are often more important than scientific projections from the outside. The DIMCP has functioned to connect scientific knowledge to experiential knowledge. For example, in detailing the science for marsh degradation, project scientists are both validating and providing an explanation for the observations locals have had for generations.

This knowledge sharing exemplifies the utility of collaborative learning and collaborative science, and builds a bridge to the local community. At the most recent workshop in January 2016, local community members were skeptical of scientific flooding projections, but listened and were interested in exploring the data nonetheless. And while the scientific projections through modeling are helpful and important to develop new knowledge about climate change vulnerabilities, there is still a lot of room for additional input and corrections that can change and refine this information. This is why in the next phase of the project we are doing ground-truthing activities to refine and better apply scientific knowledge.

Identifying vulnerability via GIS and LIDAR data is important but it does not help us to know exactly what can be done in response to threats from flooding, erosion, or storms. Focus on the science of vulnerability related to climate change is not enough. We must be better equipped to make decisions that will prepare us before storms and perturbations, instead of simply reacting after the fact. This is one of the key questions for the future of the DIMCP: are we enabling individual landowners to adapt or are we developing a mechanism for shared governance and decision making in climate change adaptation planning? The Project's ability to meet these needs

depends on a variety of factors including the will of local participants, the time and effort that the Project's managers can invest in the project, as well as structural constraints due to politics and money. Ultimately, work will fall short of developing a formal governance structure, but will help to produce some structure toward a cross-system mechanism for environmental governance. We plan to produce implementable climate change adaptation strategies within the next year.

And finally, in our effort to aid in climate change adaptation planning, we must be sure not to underestimate the utility of continued exploration of vulnerability and resilience as it is understood by stakeholders and other residents. Vulnerability and resilience are not concrete local realities but rather contextual conditions of past, present, and future reality. As fluid categories, they may change and alter with time. What may now be a vulnerability could be a resilience in the future. For example, as the Deal Island Peninsula area loses its landmass, people may begin to see the dispersal of the young as a benefit rather than a burden. But, for now this is a saddening and disturbing local reality. As in other coastal areas, the suggestion of moving people and displacing populations would be a terrible insult that fails to take into account the deep history and successful adaptation that people in this landscape have accomplished for generations. As an alternative to applying non-local logic, what happens in the future should be the result of honest appraisal of vulnerability and resilience, and conscious decision-making by informed citizens of their options. Locals, nonlocals, researchers, environmental managers, and non-profit representatives must all have a clear understanding of others perspectives and priorities to ensure future adaptation plans are in everyone's best interest.

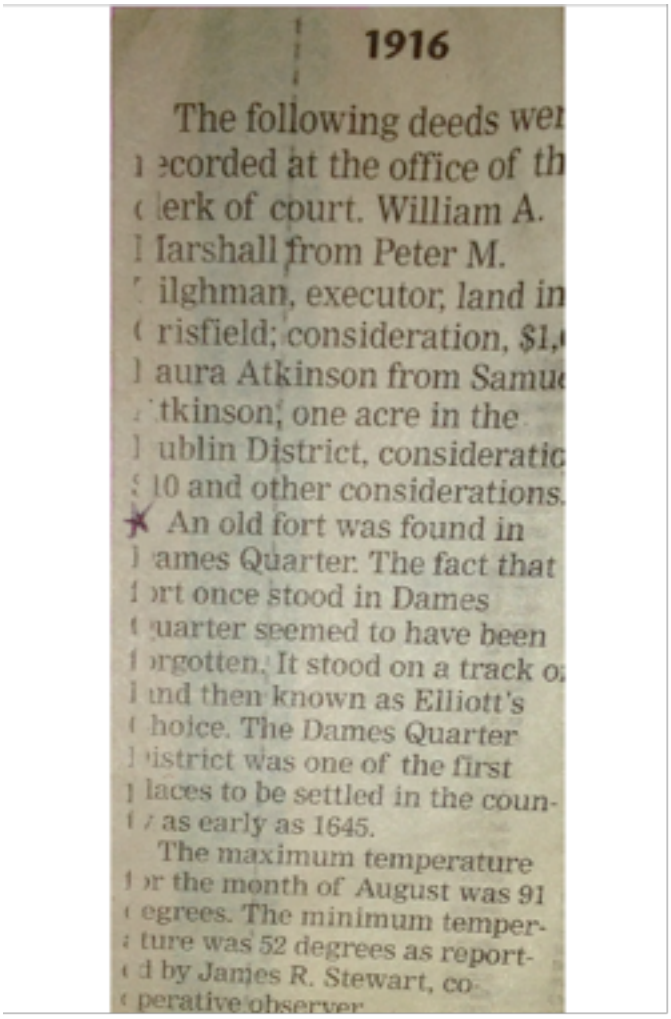
The exploration of resilience in this dissertation has highlighted only current definitions for resilience and key issue areas relevant to the local perspective. As was discussed earlier, nonlocal DIMCP stakeholders did not have much to add on resilience to the area. They of course mentioned many of the things that locals brought up such as strong social connections and faith, but nonlocals do not have an accurate idea about how these resiliencies can actually be leveraged into the future. Additional work is needed to help explore how resilience can be applied or built into the future based on current conditions. For example, how can we partner with local community members in their faith activities and in line with their beliefs and understandings about how the world works? Our inclusion of and reliance upon the local pastor is a key example of this work.

In subsequent work, I would like to explore are the suggestions that stakeholders (particularly local stakeholders) had for reducing vulnerability and building resilience in the Deal Island Peninsula area. I collected this information as a part of the semi-structured interviews but was not able to include this data as a part of the dissertation. One of the ideas that local community members had was to build better connections and cooperation amongst the social organizations of the Peninsula. It is in this process of identifying and planning for the future, such as an idea like that represents, that it will be important to identify particular areas of disagreement and contention that could stall or sever ties between local and nonlocals moving forward.

In conclusion, I highly recommend this type of applied and ethnographic anthropological focus on vulnerability and resilience to others. Theory and literature on vulnerability and resilience can help to inform such work, but ultimately it is up to

the ethnographer to define through the knowledge of constituents what vulnerability and resilience mean in a particular context. Using the literature to trace vulnerability and resilience and their implications is interesting, but what also matters is the use to which the knowledge is applied. In our case, an ongoing project to produce resilience to climate change and eventually to develop climate change adaptation strategies can benefit from more complex and well developed understandings of vulnerability and resilience. Other projects could use my research methods or interview instruments as a guide, and a key element of this work is the expertise of the ethnographer in designing and in interpreting the questions. But the most important work is in highlighting what the findings mean and in leveraging those into beneficial outcomes for local communities. It is in this work I will continue.

APPENDIX A:
Newspaper clipping about Dames Quarter, MD

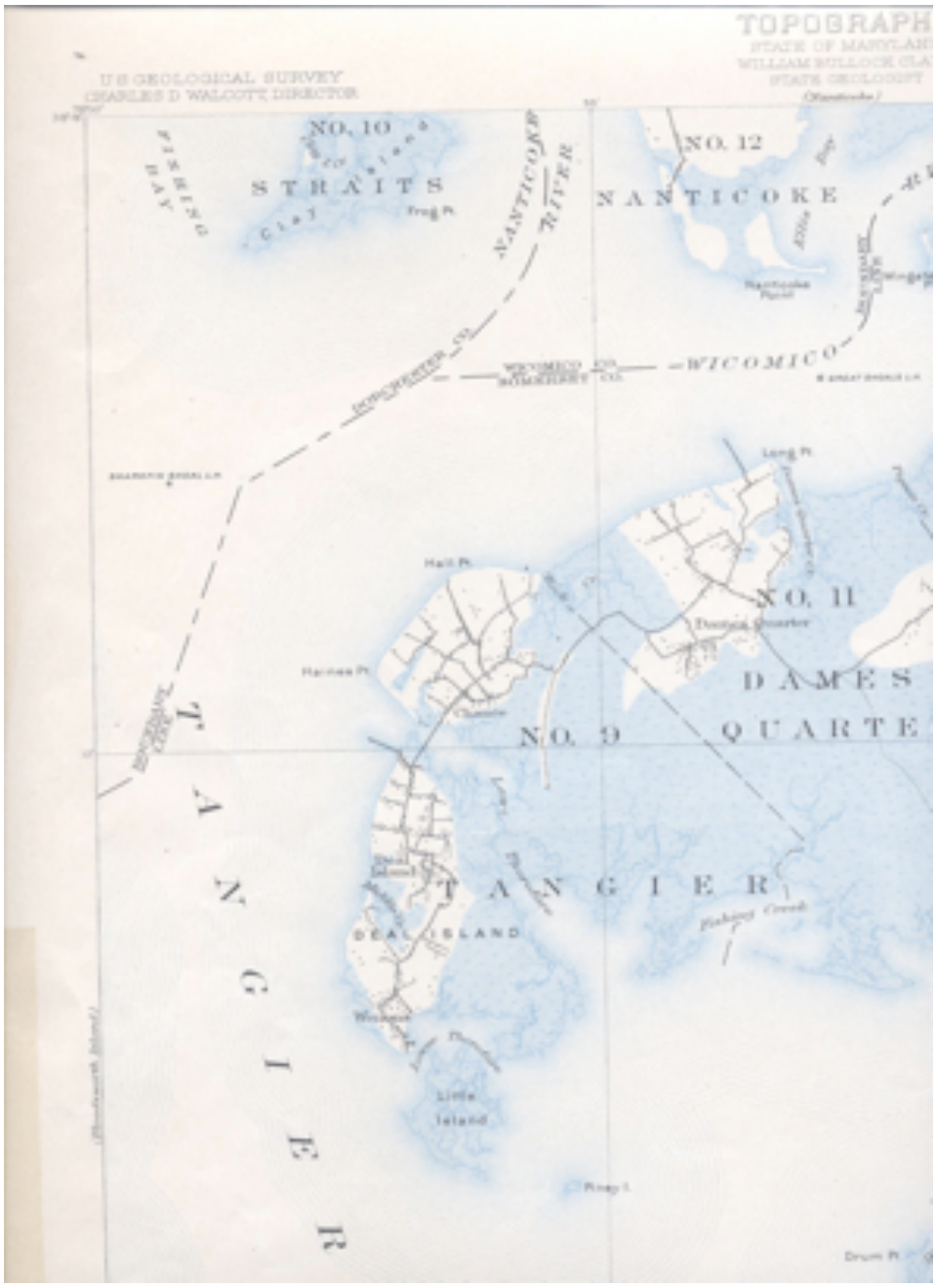


1916

The following deeds wer
ecorded at the office of th
erk of court. William A.
larshall from Peter M.
ilghman, executor, land in
risfield; consideration, $1,
aura Atkinson from Samue
tkinson; one acre in the
ublin District, consideratic
10 and other considerations.
An old fort was found in
ames Quarter. The fact that
ort once stood in Dames
uarter seemed to have been
rgotten. It stood on a track o
nd then known as Elliott's
hoice. The Dames Quarter
istrict was one of the first
laces to be settled in the coun-
as early as 1645.
The maximum temperature
or the month of August was 91
egrees. The minimum temper-
ture was 52 degrees as report-
d by James R. Stewart, co-
perative observer

Image of clipping courtesy of DIMCP stakeholder (Dames Quarter, MD resident)

APPENDIX B:
Map of Deal Island, MD from 1903 showing settlement patterns



Map by United States Geological Survey, 1903

APPENDIX C:
List of Questions from the DIMCP Stakeholder Interviews

Background info

1. Name
2. What is your relationship to the Deal Island Peninsula?
3. Stakeholder group
4. How did you become involved in this project?

The social-ecological system

1. How would you describe the environment and communities of the Deal Island Peninsula to someone who had never been here?
2. How are communities and the natural landscape linked?
3. What are important or beneficial features of the Deal Island Peninsula's landscape and environment to you? Why?
4. What are important or beneficial aspects of Deal Island's communities to you?
5. What do you see as the most valuable aspects of the community and environment?

Climate Change Threats

1. What do you think about climate change?
2. There has been a good deal in the media related to Crisfield and Hurricane Sandy. What do you think about that situation? How does it relate to Deal Island?
3. What are the threats of climate change on the Deal Island Peninsula, past, present and future?
4. What is most threatening to you and your family about climate change?
5. What are the social or ecological features that make the Peninsula vulnerable to climate change?

Social-ecological resilience

1. What are the most resilient features of the Deal Island Peninsula? The least resilient?
2. What would it mean to you to be resilient to climate change? What or who connects you to concerns about climate change?
3. What are some steps that need to happen to build resilience in the socio-ecological system of the Deal Island Peninsula?
4. Is there anything already happening to build resilience for the future?
5. What opportunities and constraints are there to developing new ways to address these vulnerabilities?
6. How do you feel about the future of the Deal Island Peninsula?

APPENDIX D:
Features of Vulnerability*

Aging community
Based on natural resources, which are variable
Changes in weather that limit livelihood activities
Choice to make a living elsewhere is more secure
Community has changed & more outsiders, but good to provide new ideas
Currents
Damage to waterfronts
Damage to wetlands
Dependent on water
Disconnection from larger Delmarva Peninsula
Fetch
Flooding
Harder to adapt when you are lacking in resources
High water table
Independence is good, but also need relationships with government and managers
Isolation
Lack of a rich fishery
Lack of jobs
Lack of relationship with outside (County and State level managers)
Land sinking
Low elevation
Low incomes make expensive solutions out of reach
Need to accept vulnerability
Need to change zoning to create less vulnerability
Need to do more to mitigate climate change impacts
No major business or employer
Nothing current for heritage- all in the past
One way in and out
Remote management of state lands (locals do not have a say)
Resource exploitation by nonlocals contributes to fisheries and other regulations
Rising sea levels
Rising tides
Saltwater intrusion
Small businesses and self-employment creates vulnerability
Storms
Style of development
Surrounded by water
Unique natural system is vulnerable
Wave energy
Wind erosion
Young do not feel they have a future there & feel forced out

**There are 41 features of vulnerability identified through semi-structured interviews with DIMCP Stakeholders.*

APPENDIX E:
Features of Resilience*

Adaptive local community
Already have done what we could
Can handle low flooding
Chesapeake Bay
Close knitted-ness
Close to nature
Come-heres (people who have moved to the area)
Cooperation
Crabs & crabbing
Creative
Environment has a steady state
Face challenges together
Few economic options
Future will be totally different
Hardened shorelines
Independence
It's all vulnerable
It's our home
Lack of civic agency
Marsh grass
Marsh management
Marshes
Marshes provide protection
No public spaces
No where else to go
Northern shorelines
Religion
Self reliance
Some are just squeaking by
The Bay "gives and takes"
Ties outside (place to go in storms)
Too many negatives
Use government better
Value history
Water will take over
Wetlands
Wild lands

**There are 37 features of resilience identified through semi-structured interviews with DIMCP Stakeholders. This list also includes negative features of resilience that interviewees mentioned.*

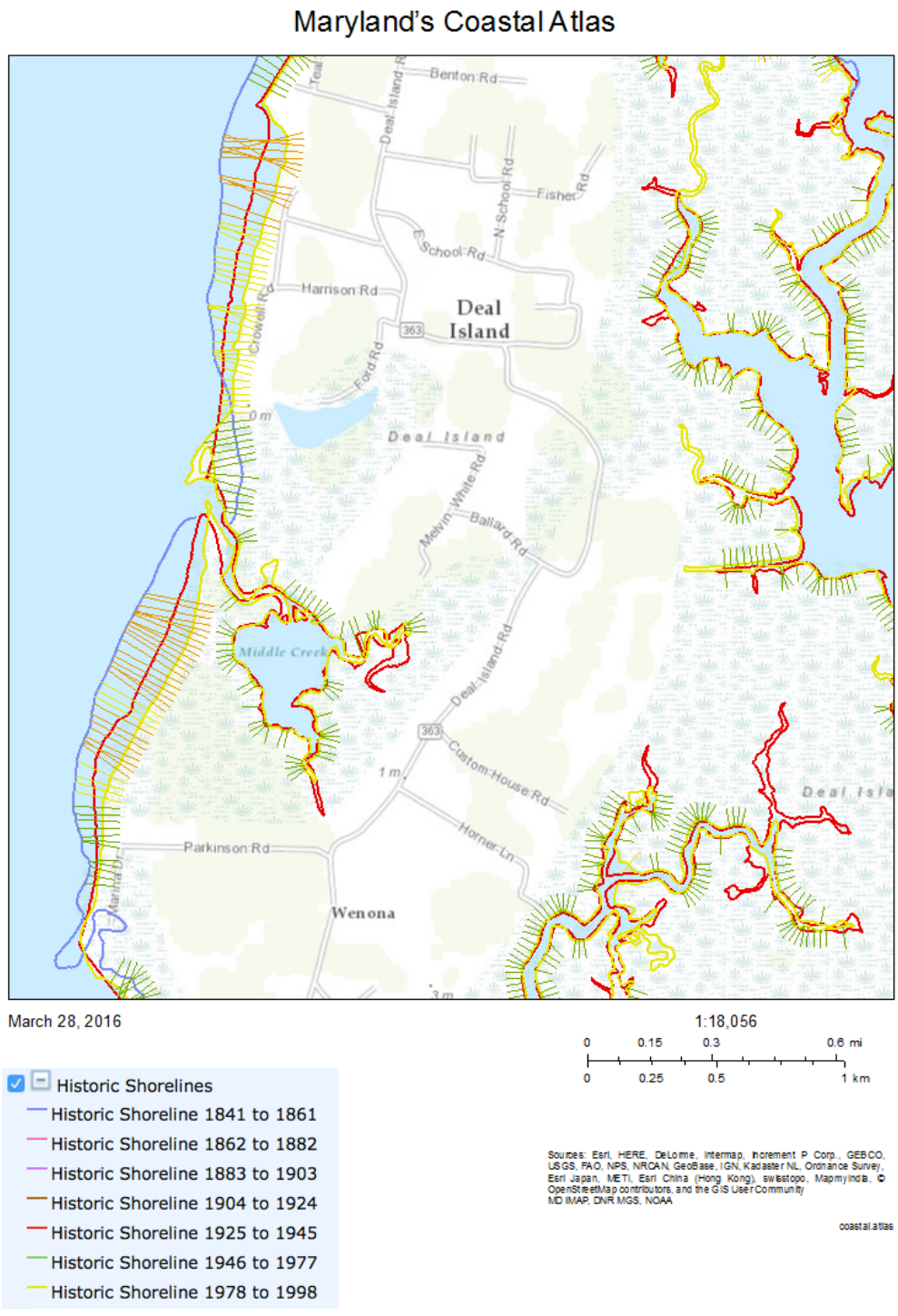
APPENDIX F:
Condensed Lists of Vulnerabilities and Resiliencies*

Vulnerabilities:
Demographics/ aging population/ young leaving/ newcomers (but new ideas good)
High water table/ saltwater intrusion
Isolation/ disconnection/ only one way in and out
Lack of action to mitigate impacts/ lack of acceptance of vulnerability
Low elevation/ land sinking
No control over natural and dynamic system
Remote management (state lands) and governance (regulations/ politics) limits choice and influence of locals
Style of development/ zoning creates vulnerability
Surrounded by water/ rising sea levels/ rising tides
Threat of storms/ flooding/ damage to waterfronts and wetlands
Wave energy/ currents/ wind erosion/ fetch
Weak economics/ lack of jobs/ dependent on water/ low incomes/ declining fishery/ limited livelihood options/ limited ability to adapt

Resiliencies:
Can handle low flooding
Close to nature/ adaptive/ creative
Crabs/ crabbing
Ethic of cooperation/ close knitted-ness
Independence/ self reliance
Marsh/ marsh grass/ protection provided by marsh
Northern shorelines/ hardened shorelines
Steadiness of environment and Bay through ebbs and flows
Strong attachment to place/ value history
Strong in faith
Ties outside (place to go in storms)

**These are features of vulnerability collapsed into categories of related items derived from the original list of 41 vulnerabilities and 37 resiliencies. Negative resiliencies are not included in the condensed resiliencies list.*

APPENDIX G:
Shoreline Change on Deal Island, MD



Source: Maryland Coastal Atlas:
http://gisapps.dnr.state.md.us/coastalatlas/iMap-master/basicviewer/index.html

APPENDIX H:
List of Vulnerabilities and Resiliencies used for Cultural Domain Analysis

- Changing demographics
- Deny vulnerability
- Distant management and governance
- Erosion
- Isolation
- Low-lying buildings
- Rising sea levels
- Rising tides
- Saltwater intrusion
- Storms
- Weak economics
- Adapt to change
- Can handle low flooding
- Crab fishery
- Ethic of cooperation
- Places nearby to go in storms
- Protected shorelines
- Protection provided by marsh
- Self-reliance
- Steadiness of environment
- Strong attachment to place
- Strong faith

APPENDIX I:
List of Structured Interview Questions

Section A:

The structured interview questions asked respondents to evaluate:

- how important a particular vulnerability or resilience item was to them (very important, somewhat important, less important, not important, cannot rate);
- to identify the timeframe for importance (now, in 5-10 years, 20-30 years, cannot rate);
- and to delineate how important it is for the network to address the vulnerability (very important, somewhat important, less important, not important, cannot rate)

The topics for these questions include: changing demographics, deny vulnerability, distant management and governance, erosion, isolation, low-lying buildings, rising sea levels, rising tides, salt water intrusion, storms, and weak economics.

Section B:

What should be the network's top priority?

Changing demographics
Deny vulnerability
Distant management and governance
Erosion
Isolation
Low lying buildings
Rising sea levels/ rising tides
Salt water intrusion
Storms
Weak economics

Which resilience feature is most important for the work of the network?

Adaptability to change
Can handle low flooding
Crab fishery
Ethic of cooperation
Places nearby to go in storms
Protected shorelines
Protection provided by marsh
Self-reliance
Steadiness of environment
Strong attachment to place

APPENDIX J
Summary Points from Conclusion (Chapter 11)

Vulnerability:

vulnerability is a dynamic concept used to describe human-environment interaction
for local stakeholders personal and cultural knowledge and experience inform understanding of vulnerabilities
vulnerabilities should be seen not as static, but complex and interacting dynamic variables
for nonlocal stakeholders what is vulnerability is driven by an interest in preserving the natural environment
for local stakeholders key vulnerabilities have to do with immediate and daily concerns of life rather than distant realities
for local stakeholders some vulnerabilities (like flooding) are normalized and an expected part of reality

Resilience:

resilience is a property of a system, system component, or people related to adaptive capacity
long-standing resiliencies of the local area more apparent to local residents, but newer forms of resilience noted by nonlocal
for local residents resilience is built in historic relationship with the area
for local residents resiliencies have aided their ability to adapt to changing environmental and social conditions
for local residents future resilience is being able to keep doing what they are doing
from the nonlocal perspective resilience is provided by building links to the outside
the DIMCP is a form of resilience
resilience is a more dynamic concept than vulnerability and provides an important source of optimism and positivity

Ethnographic Approach:

- vulnerability and resilience items represent the full social-ecological system
- emphasis must be placed on vulnerability and resilience as present realities in addition to future conditions
- vulnerability and resilience should be considered together
- progress can happen despite multiple perspectives, collaborative learning is an important mechanism for this
- the social-ecological systems perspective is useful both for broad and detailed information, but should be updated periodically

BIBLIOGRAPHY

(IPCC) Intergovernmental Panel on Climate Change. 2014. *Climate Change 2014 Synthesis Report Summary Chapter for Policymakers*. *Climate Change Report 2014*. Geneva, Switzerland.

(NOAA) National Oceanic and Atmospheric Administration. 2015. "What Is Resilience?" *Ocean Facts*. http://oceanservice.noaa.gov/facts/resilience.html.

Abel, Thomas, and John Richard Stepp. 2003. "A New Ecosystems Ecology for Anthropology." *Conservation Ecology* 7 (3): 1–12. http://search.ebscohost.com/login.aspx?direct=true&db=eih&AN=15069543&lang=es&site=ehost-live.

Adger, W. Neil. 2000. "Social and Ecological Resilience: Are They Related?" *Progress in Human Geography* 24 (3): 347–64. doi:10.1191/030913200701540465.

Adger, W. Neil., Jon Barnett, Katrina Brown, Nadine Marshall and Karen O'Brien. "Cultural dimensions of climate change impacts and adaptation." *Nature Climate Change* 3 (2): 112–117.

Agar, Michael. 1996. *The Professional Stranger : An Informal Introduction to Ethnography*. 2nd Edition. San Diego, CA: Academic Press.

Agrawal, Arun., and Nicolas Perrin. 2008. "Climate Adaptation, Local Institutions, and Rural Livelihoods." *IFRI Working Paper* W081-6.

Alexander, David. E. 2013. "Resilience and Disaster Risk Reduction: An Etymological Journey." *Natural Hazards and Earth System Sciences* 13: 2707–16. doi:10.5194/nhess-13-2707-2013.

Alston, Margaret. 2006. "'I'd Like to Just Walk Out of Here': Australian Women's Experience of Drought." *European Society for Rural Sociology* 46 (2): 154–69.

American Dreams, Inc. 2016. "Somerset County, MD Listing of Historical Places" *National Register of Historical Places for Maryland.* http://www.nationalregisterofhistoricplaces.com/md/somerset/state.html.

Amundsen, Helene. 2012. "Illusions of Resilience? An Analysis of Community Responses to Change in Northern Norway." *Ecology and Society* 17 (4): 46. http://www.ecologyandsociety.org/vol17/iss4/art46/ES-2012-5142.pdf.

Anderies, John M., Marco A. Janssen, and Elinor Ostrom. 2004. "A Framework to Analyze the Robustness of Social-Ecological Systems from an Institutional Perspective." *Ecology and Society* 9 (1): 1–18. doi:18.

Baer, Hans A. 2012. "Engaged Anthropology in 2011: A View from the Antipodes in a Turbulent Era." *American Anthropologist* 114 (2): 217–226. doi:10.1111/j.1548-1433.2012.01420.x.

Balée, William. 2012. *Inside Cultures: A New Introduction to Cultural Anthropology*. Left Coast Press. https://books.google.com/books?id=6GeapwAACAAJ&pgis=1.

Barnes, Jessica, Michael Dove, Myanna Lahsen, Andrew Mathews, Pamela McElwee, Roderick McIntosh, Frances Moore, et al. 2013. "Contribution of Anthropology to the Study of Climate Change." *Nature Climate Change* 3 (6): 541–44. doi:10.1038/nclimate1775.

Bernard, Harvey Russell. 2006. *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. Rowman Altamira. https://books.google.com/books/about/Research_Methods_in_Anthropology.html?id=LvF-afWmvlkC&pgis=1.

Bierbaum, Rosina, Joel B. Smith, Arthur Lee, Maria Blair, Lynne Carter, F. Stuart Chapin, Paul Fleming. 2013. "A Comprehensive Review of Climate Adaptation in the United States: More than Before, but Less than Needed." *Mitigation and Adaptation Strategies for Global Change* 18 (3): 361–406. doi:10.1007/s11027-012-9423-1.

Biersack, Aletta. 1999. "Introduction: From the 'New Ecology' to the New Ecologies." *American Anthropologist* 101 (1): 5–18. doi:10.1525/aa.1999.101.1.5.

Binder, Claudia R., Jochen Hinkel, Pieter W. G. Bots, and Claudia Pahl-Wostl. 2013. "Comparison of Frameworks for Analyzing Social-Ecological Systems." *Ecology and Society* 18 (4): 1–14. art26. doi:10.5751/ES-05551-180426.

Boesch, Donald F., Larry P. Atkinson, William C. Boicourt, John D. Boon, Donald R. Cahoon, Robert A. Dalrymple, Tal Ezer, Benjamin P. Horton, Zoe P. Johnson, Robert E. Kopp, Ming Li, Richard H. Moss, Adam Parris, Christopher K. Sommerfield. 2013. *Updating Maryland's Sea-Level Rise Projections. Special Report of the Scientific and Technical Working Group to the Maryland Climate Change Commission.* Cambridge, MD.

Boicourt, Kate, and Zoe Johnson, Editors. 2010. *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change, Phase II: Building Societal, Economic, and Ecological Resilience. Report of the Maryland Commision on Climate Change, Adaptation and Response and Scientific and Technical Working Groups.* Cambridge, MD and Annapolis, MD.

Borgatti, Stephen P. 1994. "Cultural Domain Analysis." *Journal of Quantitative Anthropology* 4: 261–278.

———. 1996. "Anthropac 4.0 Methods Guide." Natick, MA: Analytic Technologies.

———. 1998. "Elicitation Techniques for Cultural Domain Analysis." In *The Ethnographer's Toolkit Vol. 3*, 1–26. Walnut Creek, CA: Altamira Press.

———. 1999. "Multidimensional Scaling." Analytic Technologies. http://www.analytictech.com/borgatti/mds.htm.

Boyd, Emily, and Carl Folke. 2012. *Adapting Institutions: Governance, Complexity and Social-Ecological Resilience*. Edited by Emily Boyd and Carl Folke. Cambridge: Cambridge University Press. https://books.google.com/books/about/Adapting_Institutions.html?id=5r-r9ptA6QwC&pgis=1.

Brown, Katrina. 2014. "Global Environmental Change I: A Social Turn for Resilience?" *Progress in Human Geography* 38 (1): 107–17. doi:10.1177/0309132513498837.

Browne, William Hand (Editor). 1893. *Journal and Correspondence of the Maryland Council of Safety July 7- December 31, 1776. Archives of Maryland*. Baltimore, MD. https://play.google.com/store/books/details?id=JOU5AQAAMAAJ&rdid=book-JOU5AQAAMAAJ&rdot=1.

Buikstra, Elizabeth, Helen Ross, Christine A. King, Peter G. Baker, and Kathryn Mclachlan. 2010. "The Components of Resilience — Perceptions of an Australian Rural Community." *Library* 38 (8): 975–91. doi:10.1002/jcop.

Cameron, Emilie S. 2012. "Securing Indigenous Politics: A Critique of the Vulnerability and Adaptation Approach to the Human Dimensions of Climate Change in the Canadian Arctic." *Global Environmental Change* 22 (1). Elsevier Ltd: 103–14. doi:10.1016/j.gloenvcha.2011.11.004.

Chambers, Erve. 2006. *Heritage Matters: Heritage, Culture, History, and Chesapeake Bay*. College Park, MD: Maryland Sea Grant.

Chapin, F. Stuart, Stephen R. Carpenter, Gary P. Kofinas, Carl Folke, Nick Abel, William C. Clark, Per Olsson, D. Mark Stafford Smith, Brian Walker, Oran R. Young, Fikret Berkes, Reinette Biggs, J. Morgan Grove, Rosamond L. Naylor, Evelyn Pinkerton, Will Steffan and Frederick J. Swanson. 2010. "Ecosystem Stewardship: Sustainability Strategies for a Rapidly Changing Planet." *Trends in Ecology & Evolution* 25 (4): 241–49. doi:10.1016/j.tree.2009.10.008.

Chesapeake Bay Program. 2012a. "How We Work." *About the Bay Program*. http://www.chesapeakebay.net/about/how.

———. 2012b. "Accomplishments." *About the Bay Program*. http://www.chesapeakebay.net/about/how/accomplishments.

Cote, Muriel, and Andrea J. Nightingale. 2012. "Resilience Thinking Meets Social Theory Situating Social Change in Socio-Ecological Systems (SES) Research." *Progress in Human Geography* 36 (4): 475–89. doi:10.1177/0309132511425708.

Crane, Todd. 2010. "Of Models and Meanings : Cultural Resilience in Social – Ecological Systems." *Ecology and Society* 15 (4) 1–16.

Crate, Susan A. 2011. "Climate and Culture: Anthropology in the Era of Contemporary Climate Change." *Annual Review of Anthropology* 40 (1): 175–94. doi:10.1146/annurev.anthro.012809.104925.

Crate, Susan A., and Mark Nuttall. 2009. *Anthropology and Climate Change: From Encounters to Actions*. Left Coast Press. https://books.google.com/books/about/Anthropology_and_climate_change.html?id=VpUgAQAAIAAJ&pgis=1.

Cronin, William B. 2005. *The Disappearing Islands of the Chesapeake*. Baltimore, MD: JHU Press. https://books.google.com/books/about/The_Disappearing_Islands_of_the_Chesapea.html?id=itFf6wHY_D4C&pgis=1.

Cruikshank, Julie. 2010. *Do Glaciers Listen?: Local Knowledge, Colonial Encounters, and Social Imagination*. UBC Press. https://books.google.com/books/about/Do_Glaciers_Listen.html?id=Nt5OumYWApQC&pgis=1.

Curtin, Charles G. 2014. "Resilience Design: Toward a Synthesis of Cognition, Learning, and Collaboration for Adaptive Problem Solving in Conservation and Natural Resource Stewardship." *Ecology and Society* 19 (2). doi:10.5751/ES-06247-190215.

D'Andrade, Roy. 2005. "Some Methods for Studying Cultural Cognitive Structures." In *Finding Culture in Talk: A Collection of Methods*, edited by Naomi Quinn,

269. Palgrave Macmillan.
Daniels, Steven E., and Gregg B. Walker. 2001. *Working Through Environmental Conflict: The Collaborative Learning Approach*. Praeger. https://books.google.com/books?id=az9-AAAAMAAJ&pgis=1.
Davoudi, Simin, and Libby Porter. 2012. "Applying the Resilience Perspective to Planning: Critical Thoughts from Theory and Practice." *Planning Theory & Practice* 13 (2): 299–333. doi:10.1080/14649357.2012.677124.
Davoudi, Simin, Keith Shaw, L. Jamila Haider, Allyson E. Quinlan, Garry D. Peterson, Cathy Wilkinson, Hartmut Fünfgeld, Darryn McEvoy, and Libby Porter. 2012. "Resilience: A Bridging Concept or a Dead End? 'Reframing' Resilience: Challenges for Planning Theory and Practice Interacting Traps: Resilience Assessment of a Pasture Management System in Northern Afghanistan Urban Resilience: What Does It Mean in Planni." *Planning Theory & Practice* 13 (2): 299–333. doi:10.1080/14649357.2012.677124.
DeWalt, Kathleen Musante, and Billie R. DeWalt. 2002. *Participant Observation: A Guide for Fieldworkers*. Rowman Altamira. https://books.google.com/books?id=p1wcO3UNXQ4C&pgis=1.
Dews, Fred, and Shawn Dhar. 2015. "U.S. Climate Envoy Todd Stern on What We Accomplished at Paris Climate Conference (COP21)." *Understanding COP21 and Beyond*. Washington, DC: Brookings Institution. http://www.brookings.edu/blogs/planetpolicy/posts/2015/12/18-todd-stern-accomplishments-paris-climate-talks.
Dove, Michael, and Carol Carpenter. 2008. *Environmental Anthropology: A Historical Reader*. Blackwell Pub. https://books.google.com/books/about/Environmental_anthropology.html?id=IQgPAQAAMAAJ&pgis=1.
Duyer, Linda. 2014. "Dames Quarter School: Slipping off the Rosenwald List | Delmarva African American History on WordPress.com." *Delmarva African American History*. https://aahistorydelmarva.wordpress.com/2014/04/27/dames-quarter-school-slipping-off-the-rosenwald-list/.
Eggleston, Jack, and Jason Pope. 2013. *Land Subsidence and Relative Sea-Level Rise in the Southern Chesapeake Bay Region*. https://apps.doi.gov/circ/1392/pdf/,DanaInfo=pubs.usgs.gov+circ1392.pdf.
Ernst, Howard R. 2003. *Chesapeake Bay Blues: Science, Politics, and the Struggle to Save the Bay*. Lanham: Rowman & Littlefield. https://books.google.com/books?id=kzyIeLjfhBIC&pgis=1.
Erwin, R. Michael, David F. Brinker, Bryan D. Watts, Gary R. Costanzo, and David D. Morton. 2011. "Islands at Bay: Rising Seas, Eroding Islands, and Waterbird Habitat Loss in Chesapeake Bay (USA)." *Journal of Coastal Conservation* 15 (1): 51–60. doi:10.1007/s11852-010-0119-y.
Fabinyi, Michael, Louisa Evans, and Simon J. Foale. 2014. "Social-Ecological Systems, Social Diversity, and Power: Insights from Anthropology and Political Ecology." *Ecology and Society* 19 (4). doi:10.5751/ES-07029-190428.
Falzon, Mark-Anthony. 2009. *Multi-Sited Ethnography: Theory, Praxis and Locality in Contemporary Research*. Abingdon: Ashgate Publishing, Ltd. https://books.google.com/books?id=fNB7BgAAQBAJ&pgis=1.

Federal Writers Project. 2014. *The WPA Guide to Maryland: #7 The Old Line State*. Vol. (1940). San Antonio: Trinity University Press. https://books.google.com/books?id=_F7pCAAAQBAJ&pgis=1.

Feurt, Christine Baumann. 2008. *Collaborative Learning Guide*. Wells, ME. http://www.wellsreserve.org/sup/downloads/collaborative_learning_guide.pdf.

———. 2012. "Collaborative Learning Strategies to Overcome Barriers to Ecosystem Management in Coastal Watersheds of the Gulf of Maine." *American Fisheries Society Symposium* 79 (000-000): 1–16.

Fincham, Michael W. 2010. "Chesapeake Quarterly Volume 9, Number 4: Going to Extremes: The Storm over Hurricanes." *Chesapeake Quarterly*, December. http://www.chesapeakequarterly.net/V09N4/main1/.

Fiske, Shirley J. 2012. "Why Climate Matters…." *Counterpunch*. http://www.counterpunch.org/2012/11/02/why-climate-matters/.

Fiske, Shirley J., Susan A. Crate, Carole L. Crumley, Kathleen Galvin, Heather Lazrus, George Luber, Anthony Oliver-Smith, Ben Orlove, Sarah Strauss, and Richard R. Wilk. 2014. *Changing the Atmosphere Anthropology and Climate Change*. Arlington, VA.

Folke, Carl. 2006. "Resilience: The Emergence of a Perspective for Social–Ecological Systems Analyses." *Global Environmental Change* 16 (3): 253–67. doi:10.1016/j.gloenvcha.2006.04.002.

Folke, Carl, Stephen R. Carpenter, Brian Walker, Marten Scheffer, Terry Chapin, and Johan Rockstrom. 2010. "Resilience Thinking: Integrating Resilience, Adaptability and Transformability." *Ecology and Society* 15 (4). doi:10.1038/nnano.2011.191.

Folke, Carl, Johan Colding, and Fikret Berkes. 2002. "Synthesis: Building Resilience and Adaptive Capacity in Social-Ecological Systems." In *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, edited by Carl Folke, Johan Colding, and Fikret Berkes, 352–87. New York: Cambridge University Press.

Ford, James D., Barry Smit, Johanna Wandel, and John MacDonald. 2006. "Vulnerability to Climate Change in Igloolik, Nunavut: What We Can Learn from the Past and Present." *Polar Record* 42 (02): 127. doi:10.1017/S0032247406005122.

Forstall, Richard L. 1996. *Population of States and Counties of the United States 1790-1990*. Washington, DC. https://www.census.gov/population/www/censusdata/PopulationofStatesandCountiesoftheUnitedStates1790-1990.pdf.

Füssel, Hans Martin, and Richard J. T. Klein. 2006. "Climate Change Vulnerability Assessments: An Evolution of Conceptual Thinking." *Climatic Change* 75 (3): 301–29. doi:10.1007/s10584-006-0329-3.

Gallopin, Gilberto C. 2006. "Linkages between Vulnerability, Resilience, and Adaptive Capacity." *Global Environmental Change* 16 (3): 293–303. doi:10.1016/j.gloenvcha.2006.02.004.

Goring, Simon J., Kathleen C. Weathers, Walter K. Dodds, Patricia A. Soranno, Lynn C. Sweet, Kendra S. Cheruvelil, John S. Kominoski, Janine Rüegg, Alexandra M. Thorn, and Ryan M. Utz. 2014. "Improving the Culture of Interdisciplinary

Collaboration in Ecology by Expanding Measures of Success." *Frontiers in Ecology and the Environment* 12 (1): 39–47. doi:10.1890/120370.
Gotham, Kevin, and Richard Campanella. 2013. "Constructions of Resilience: Ethnoracial Diversity, Inequality, and Post-Katrina Recovery, the Case of New Orleans." *Social Sciences* 2 (4): 298–317. doi:10.3390/socsci2040298.
Holling, C S. 1973. "Resilience and Stability of Ecological Systems." *Annual Review of Ecology and Systematics* 4 (1): 1–23. doi:10.1146/annurev.es.04.110173.000245.
Horton, Tom. 2013. *Turning the Tide: Saving the Chesapeake Bay*. Washington: Island Press. https://books.google.com/books?hl=en&lr=&id=FHCtrYIDq0MC&pgis=1.
Hulme, Mike. 2008. "Geographical Work at the Boundaries of Climate Change." *Transactions of the Institute of British Geographers* 33 (1): 5–11. doi:10.1111/j.1475-5661.2007.00289.x.
Janssen, Marco A. 2007. "An Update on the Scholarly Networks on Resilience , Vulnerability , and Adaptation within the Human Dimensions of Global Environmental Change" 12 (2).
Janssen, Marco, Örjan Bodin, John M. Anderies, Thomas Elmqvist, Henrik Ernstson, Ryan R. J. Mcallister, Per Olsson, and Paul Ryan. 2006. "Toward a Network Perspective of the Study of Resilience in Social-Ecological Systems." *Ecology and Society* 11 (1): 15.
Jarrett, Robin L. 1997. "Resilience among Low-Income African American Youth: An Ethnographic Perspective." *Ethos* 25 (2): 218–29. doi:10.2307/640356.
Kearney, Michael S. 2012. "Sea-Level Change during the Last Thousand Years in Chesapeake Bay." *Coastal Education & Research Foundation* 12 (4): 977–83.
Kelly, P. M., and W. Neil Adger. 2000. "Theory and Practice in Assessing Vulnerability To," 325–52.
Kelman, Ilan, and J. C. Gaillard. 2010. "Embedding Climate Change Adaptation within Disaster Risk Reduction." In *Climate Change Adaptation and Disaster Risk Reduction: Issues and Challenges: Issues and Challenges*, edited by Juan Pulhin, Rajib Shaw, and Joy J. Pereira, 23–47. Emerald Group Publishing. https://books.google.com/books?hl=en&lr=&id=3XeIzLwD2kEC&pgis=1.
Kelman, Ilan, J. C. Gaillard, and Jessica Mercer. 2015. "Climate Change's Role in Disaster Risk Reduction's Future: Beyond Vulnerability and Resilience." *International Journal of Disaster Risk Science*, 21–27. doi:10.1007/s13753-015-0038-5.
Kemp, W. M., W.R. Boynton, J.E. Adolf, D.F. Boesch, W.C. Boicourt, G. Brush, J. C. Cornwell, et al. 2005. "Eutrophication of Chesapeake Bay: Historical Trends and Ecological Interactions. Marine Ecology Progress Series." *Marine Ecology Progress Series* 303: 1–29. doi:10.3354/meps303001.
Kempton, Willett, James S. Boster, and Jennifer A. Hartley. 1996. *Environmental Values in American Culture*. Cambridge, MA: MIT Press. https://books.google.com/books/about/Environmental_Values_in_American_Culture.html?id=ePM2u-ZKrfcC&pgis=1.
Kirwan, Matthew L., and J. Patrick Megonigal. 2013. "Tidal Wetland Stability in the Face of Human Impacts and Sea-Level Rise." *Nature* 504 (7478): 53–60.

doi:10.1038/nature12856.
Lansing, J. Stephen. 2003. “Complex Adaptive Systems.” *Annual Review of Anthropology* 32: 183–204. doi:10.1146/annurev.anthro.32.061002.093440.
Laska, Shirley, Kristina Peterson, Michele E. Alcina, Jonathan West, Ashley Volion, Brent Tranchina, and Richard Krajeski. 2010. *Enhancing Gulf of Mexico Coastal Communities ’ Resiliency Through Participatory Community Engagement*. New Orleans.
Lassiter, Luke Eric. 2014. *Invitation to Anthropology*. Rowman & Littlefield Publishers. https://books.google.com/books?hl=en&lr=&id=CUGSAgAAQBAJ&pgis=1.
Lazrus, Heather. 2012. “Sea Change: Island Communities and Climate Change.” *Annual Review of Anthropology* 41: 285–301. doi:10.1146/annurev-anthro-092611-145730.
Leatherman, Stephen P., Ruth Chalfont, Edward C. Pendleton, Tamara L. McCandless, and Steve Funderburk. 1995. “Vanishing Lands: Sea Level, Society and Chesapeake Bay.” Annapolis, MD: U.S. Fish and Wildlife Service, Chesapeake Bay Program. http://www.fws.gov/slamm/VanishingLandsSeaLevelSocietyandChesapeakeBay2.pdf.
Lefferts, Walter. 1918. “Tidewater Maryland: An Embayed Coastal Plain.” *Thesis*. University of Pennsylvania. https://archive.org/details/tidewatermarylan00leffrich.
Lesser, Cyrus R. 1982. “The Effects of Open Marsh Water Management on the Ecology of Chesapeake Bay High Marsh Wetlands.” *U.S. Government Printing Office Records*. https://www.gpo.gov/fdsys/pkg/CZIC-qh105-m3-l47-1982/html/CZIC-qh105-m3-l47-1982.htm.
Lippson, Alice Jane, and Robert L. Lippson. 2006. *Life in the Chesapeake Bay*. Baltimore, MD: JHU Press. https://books.google.com/books?id=PtnMBOYog7EC&pgis=1.
Luthar, Suniya S., Dante Cicchetti, and Bronwyn Becker. 2000. “The Construct of Resilience: A Critical Evaluation and Guidelines for Future Work.” *Child Development* 71 (3): 543–62. doi:10.1111/1467-8624.00164.
Luttrell, Wendy. 2005. “‘Good Enough’ Methods for Life-Story Analysis.” In *Finding Culture in Talk: A Collection of Methods*, edited by Naomi Quinn, 268. New York: Palgrave Macmillan.
Lyon, John C. 2004. “Early Somerset and Other Early 17th Century Settlements on the Lower Shore.” *Somerset MDGenWeb: Lyon Maps*. http://www.mdgenweb.org/somerset/lyonmaps/earlysomerset1.htm.
Maclean, Kirsten, Michael Cuthill, and Helen Ross. 2014. “Six Attributes of Social Resilience.” *Journal of Environmental Planning and Management* 57 (1): 144–56. doi:10.1080/09640568.2013.763774.
Magis, Kristen. 2010. “Community Resilience: An Indicator of Social Sustainability.” *Society & Natural Resources: An International Journal* 23 (5): 401–16. doi:10.1080/08941920903305674.
Manuel-Navarrete, David. 2015. “Double Coupling: Modeling Subjectivity and Asymmetric Organization in Social-Ecological Systems.” *Ecology and Society*

20 (3). doi:10.5751/ES-07720-200326.
Marcus, George E. 1995. “Ethnography In/of the World System: The Emergence of Multi-Sited Ethnography.” *Annual Review of Anthropology* 24: 95–117. doi:10.1146/annurev.an.24.100195.000523.
Maryland Department of Natural Resources. 2008. *Somerset County, Maryland: Rising Sea Level Guidance*. http://maryland.coastsmart.org/wp-content/themes/checkmate/documents/SomersetSLRGuidance.pdf.
———. 2016. “Deal Island WMA.” *Deal Island Wildlife Management Area*. http://dnr2.maryland.gov/wildlife/Pages/publiclands/eastern/dealisland.aspx.
Maryland Department of Natural Resources Watershed Services Coastal Zone Management. 2012. *Chesapeake Bay National Estuarine Research Reserve Maryland Final Management Plan : 2008-2012*. *Construction*. Annapolis, MD.
Mcaslan, Alastair. 2011. *Community Resilience: Understanding the Concept and Its Application*. Adelaide, Australia. doi:10.1057/9780230355101.0007.
McCay, Bonnie J. 1978. “Systems Ecology, People Ecology, and the Anthropology of Fishing Communities.” *Human Ecology* 6 (4): 397–422. doi:10.1007/BF00889417.
McCubbin, Sandra, Barry Smit, and Tristan Pearce. 2015. “Where Does Climate Fit? Vulnerability to Climate Change in the Context of Multiple Stressors in Funafuti, Tuvalu.” *Global Environmental Change* 30. Elsevier Ltd: 43–55. doi:10.1016/j.gloenvcha.2014.10.007.
McGinnis, Michael D., and Elinor Ostrom. 2014. “Social-Ecological System Framework: Initial Changes and Continuing Challenges.” *Ecology and Society* 19 (2): 30. doi:10.5751/ES-06387-190230.
Miller Hesed, Christine D., and Michael Paolisso. 2015. “Cultural Knowledge and Local Vulnerability in African American Communities.” *Nature Climate Change* 5 (7): 683–87. doi:10.1038/nclimate2668.
Mullikin, James C. 1971. “The Eastern Shore.” In *The Old Line State: A History of Maryland*, edited by Morris L. Radoff, 149–61. Baltimore, MD: Twentieth Century Printing Company, Inc.
Najjar, Raymond G., Christopher R. Pyke, Mary Beth Adams, Denise Breitburg, Carl Hershner, Michael Kemp, Robert Howarth, et al. 2010. “Potential Climate-Change Impacts on the Chesapeake Bay.” *Estuarine, Coastal and Shelf Science* 86 (1): 1–20. doi:10.1016/j.ecss.2009.09.026.
National Research Council. 2004. *Nonnative Oysters in the Chesapeake Bay*. Washington, DC: National Academies Press.
National Trust for Historic Preservation. 2016. “Rosenwald Schools, A National Treasure.” *Rosenwald Schools Initiative*. Accessed February 13. http://www.preservationnation.org/rosenwald/.
Needelman, Brian A., Stephen Crooks, Janet E. Hawkes, Caroly Shumway, James G. Titus, Rich Takacs and eds. Needelman, B.A., J. Benoit, S. Bosak, C. Lyons. 2012. *Restore-Adapt-Mitigate: Responding to Climate Change Through Coastal Habitat Restoration*. Washington, DC. http://estuaries.org/reports/.
Needelman, Brian, Michael Paolisso, Sasha Land, Paul Leisnham, Andrew Baldwin, Katherine Johnson, Lisa Wainger, Anna McMurray, and Jennifer Dindinger. 2015. *Integrating Socio-Ecological Research and Collaborative Learning to*

Promote Marsh and Community Resilience: Final Project Report 9/1/12-6/30/15. College Park, MD.
Nelson, Donald R. 2011. "Adaptation and Resilience: Responding to a Changing Climate." *Climate Change* 2: 113–20. doi:10.1002/wcc.91.
Nelson, Donald R., W. Neil Adger, and Katrina Brown. 2007. "Adaptation to Environmental Change: Contributions of a Resilience Framework." *Annual Review of Environment and Resources* 32 (1): 395–419. doi:10.1146/annurev.energy.32.051807.090348.
NOAA Office for Coastal Management. 2015. "National Estuarine Research Reserve Science Collaborative Projects." *Science Collaborative Project Descriptions*. http://nerrs.noaa.gov/research/science-collaborative-projects.html.
———. 2016. "National Estuarine Research Reserve System." *Chesapeake Bay-Maryland National Estuarine Research Reserve*. http://nerrs.noaa.gov/reserves/chesapeake-bay-md.html.
Nuttall, Mark. 2009. "Living in a World of Movement: Human Resilience to Environmental Instability in Greenland." In *Anthropology and Climate Change: From Encounters to Actions*, edited by Susan A. Crate and Mark Nuttall, 292–310. Walnut Creek, CA: Left Coast Press, Inc.
Nykvist, Bjorn, and Jacob von Heland. 2014. "Social-Ecological Memory as a Source of General and Specified Resilience." *Ecology and Society* 19 (2). doi:10.5751/ES-06167-190247.
O'Conor, Herbert. 1940. *Maryland A Guide To The Old Line State*. Edited by Writer's Program of the Work Projects Administration in the State of Maryland. Oxford University Press. https://archive.org/details/marylandaguideto012121mbp.
Ogden, Laura, Nik Heynen, Ulrich Oslender, Paige West, Karim-Aly Kassam, and Paul Robbins. 2013. "Global Assemblages, Resilience, and Earth Stewardship in the Anthropocene." *Frontiers in Ecology and the Environment* 11 (7): 341–47. doi:10.1890/120327.
Oliver-Smith, Anthony. 2009. "Sea Level Rise and the Vulnerability of Coastal Peoples Responding to the Local Challenges of Global Climate Change in the 21 St Century." *Intersections Publication Series UNU-EHS*. (7): 1–56.
———. 2012. "Debating Environmental Migration: Society, Nature and Population Displacement in Climate Change." *Journal of International Development* 24: 1058–70. doi:10.1002/jid.2887.
———. 2013. "Disaster Risk Reduction and Climate Change Adaptation: The View from Applied Anthropology." *Human Organization* 72 (4): 275–82.
Oliver-Smith, Anthony, Susan L. Cutter, Koko Warner, Cosmin Corendea, and Kristina Yuzva. 2012. *Addressing Loss and Damage in the Context of Social Vulnerability and Resilience*. *UNU-EHS Publication Series: Policy Brief No. 7*. Tokyo, Japan.
Orlove, Ben 2009. "The Past, the Present and Some Possible Futures of Adaptation." In *Adapting to Climate Change: Thresholds, Values, Governance*, edited by W. Neil Adger, Irene Lorenzoni, and Karen O'Brien, 131–63. Cambridge: Cambridge University Press. http://papers.ssrn.com/abstract=2240439.
Ostrom, Elinor. 2009. "A General Framework for Analyzing Sustainability of Social-

Ecological Systems." *Science (New York, N.Y.)* 325: 419–22. doi:10.1126/science.1172133.
Paolisso, Michael. 2002. "Blue Crabs and Controversy on the Chesapeake Bay: A Cultural Model for Understanding Watermen's Reasoning about Blue Crab Management." *Human Organization* 61 (3): 226–39.
———. 2005. "The Right to Work the Water." *Waterman's Gazette*, May.
———. 2007. "Taste the Traditions: Crabs, Crab Cakes, and the Chesapeaek Bay Blue Crab Fishery." *American Anthropologist* 109 (4): 654–65.
Paolisso, Michael, Ellen Douglas, Ashley Enrici, Paul Kirshen, Chris Watson, and Matthias Ruth. 2012. "Climate Change, Justice, and Adaptation among African American Communities in the Chesapeake Bay Region." *Weather Climate and Society* 4 (1): 34–47. doi:10.1175/wcas-d-11-00039.1.
Pelling, Mark. 2011. *Adaptation to Climate Chante: From Resilience to Transformation*. London: Routledge Taylor & Francis Group. doi:10.1073/pnas.0703993104.
Pelton, Tom, and Bill Goldsborough. 2008. *Bad Water and the Decline of Blue Crabs in the Chesapeake Bay*. *Cheapeake Bay Foundation Reports*. Annapolis, MD. http://www.cbf.org/badwaters.
Polk, John. 2000. "LOWER-DELMARVA-ROOTS-L Archives." *Damned Quarter*. http://archiver.rootsweb.ancestry.com/th/read/LOWER-DELMARVA-ROOTS/2000-04/0956986209.
Power, Lucinda P., and Michael Paolisso. 2005. *Linking Estuarine Ecology and Community Heritage : A Socio-Cultural Needs Assessment of the Monie Bay Component*. College Park, MD.
———. 2007. "Linking Estuarine Research to Local Community Heritage & Environmental Values : Lessons from the Chesapeake Bay." *Practicing Anthropology* 29 (1): 29–34.
Preston, Benjamin L., Emma J. Yuen, and Richard M. Westaway. 2011. "Putting Vulnerability to Climate Change on the Map: A Review of Approaches, Benefits, and Risks." *Sustainability Science* 6 (2): 177–202. doi:10.1007/s11625-011-0129-1.
Puntenney, Pamela J. 2009. "Where Managerial and Scientific Knowledge Meet Sociocultural Systems." In *Anthropology and Climate Change: From Encounters to Actions*, edited by Susan A. Crate and Mark Nuttall, 311–26. Walnut Creek, CA: Left Coast Press, Inc.
Radoff, Morris L. 1971. "The Settlement." In *The Old Line State: A History of Maryland*, edited by Morris L. Radoff, 1–10. Annapolis, MD: Twentieth Century Printing Company, Inc.
Rayner, Steve. 2003. "Domesticating Nature: Commentary on the Anthropological Study of Weather and Climate Discourse." In *Weather, Climate, Culture*, edited by Sarah Strauss and Ben Orlove, 277–90. Oxford: Berg.
Rhodes, Jason. 2007. *Somerset County, Maryland: A Brief History*. Charleston: The History Press. https://books.google.com/books/about/Somerset_County_Maryland.html?id=9AQghKFhr38C&pgis=1.
Roberts, Winthrop A. 1905. *The Crab Industry of Maryland,. Appendix to the Report*

of the Commisioner of Fisheries to the Secretary of Commerce and Labor for the Year Ending June 30, 1904. Washington, DC: Government Printing Office. http://hdl.handle.net/2027/hvd.hwgm3l.

Robinson, Patrick, Ken Genskow, Bret Shaw, and Robin Shepard. 2012. "Barriers and Opportunities for Integrating Social Science into Natural Resource Management: Lessons from National Estuarine Research Reserves." *Environmental Management* 50 (6): 998–1011. doi:10.1007/s00267-012-9930-6.

Roncoli, Carla. 2006. "Ethnographic and Participatory Approaches to Research on Farmers' Responses to Climate Predictions." *Climate Research* 33: 81–99.

Roncoli, Carla, Todd Crane, and Benjamin S Orlove. 2009. "Fielding Climate Change in Cultural Anthropology." In *Anthropology and Climate Change: From Encounters to Actions*, 87–115. http://books.google.com/books?id=VpUgAQAAIAAJ&pgis=1.

Ross, Helen, Michael Cuthill, Kirsten Maclean, Danni Jansen, and Bradd Witt. 2010. *Understanding, Enhancing and Managing for Social Resilience at the Regional Scale: Opportunities in North Queensland*. *Report to the Marine and Tropical Sciences Research Facility*. Vol. 1. Cairns. doi:10.1017/CBO9781107415324.004.

Rowley, Nick. 2015. "The Road to Paris: Three Myths about International Climate Talks." *Energy Post*. http://www.energypost.eu/road-paris-three-myths-international-climate-talks/.

Rudiak-Gould, Peter. 2011. "The Importance of Reception Studies" 27 (2): 9–12.

Ruiz-Mallen, Isabel, and Esteve Corbera. 2013. "Community-Based Conservation and Traditional Ecological Knowledge: Implications for Social-Ecological Resilience." *Ecology and Society* 18 (4): 12. doi:10.5751/ES-05867-180412.

Ryan, Gery W., and H. Russell Bernard. 2003. "Techniques to Identify Themes." *Field Methods* 15 (1): 85–109. doi:10.1177/1525822X02239569.

Scott, Jane. 1991. *Between Ocean and Bay: A Natural History of Delmarva*. Centreville, MD: Tidewater Publishers. https://books.google.com/books/about/Between_Ocean_and_Bay.html?id=FdwTAQAAIAAJ&pgis=1.

Shaffer, L. Jen, and Leocadia Naiene. 2011. "Why Analyze Mental Models of Local Climate Change? A Case from Southern Mozambique." *Weather, Climate, and Society* 3 (4): 223–37. doi:10.1175/WCAS-D-10-05004.1.

Skipjack Heritage Inc. 2014. "Our Skipjack Heritage." *About Skipjack Heritage*. http://www.skipjacklore.org/.

Somerset County. 2015. "2015 Flood Plain Map." http://www.somersetmd.us/maps/PrelimFloodMap.pdf.

Spanger-Siegfried, Erika, Melanie Fitzpatrick, and Kristina Dahl. 2014. *Encroaching Tides: How Sea Level Rise and Tidal Flooding Threaten U.S. East and Gulf Coast Communities over the Next 30 Years*. *Union of Concerned Scientists*. Cambridge, MA.

Stain, Helen J., Brian Kelly, Vaughan J. Carr, Terry J. Lewin, Michael Fitzgerald, and Lyn Fragar. 2011. "The Psychological Impact of Chronic Environmental Adversity: Responding to Prolonged Drought." *Social Science & Medicine* 73 (11). Elsevier Ltd: 1593–99. doi:10.1016/j.socscimed.2011.09.016.

Stiverson, Gregory A. (Assistant State Archivist). 1977. “History of the Deal Island Area, 1607-1877.”

Strauss, Sarah, and Ben Orlove. 2003. “Up in the Air: The Anthropology of Weather and Climate.” In *Weather, Climate, Culture*, edited by Sarah Strauss and Ben Orlove, 3–16. Oxford: Berg. https://scholar.google.com/citations?view_op=view_citation&hl=en&user=TmjPUm0AAAAJ&citation_for_view=TmjPUm0AAAAJ:ULOm3_A8WrAC.

Swenson, Ben. 2013. “Historically African American Beaches; Vanished Relics of an Uncomfortable Past | Abandoned Country.” *Abandonded Country*. http://www.abandonedcountry.com/2013/05/20/historically-african-american-beaches-vanished-relics-of-an-uncomfortable-past/.

The White House. 2016. “Climate Change Resilience.” *Council on Environmental Quality: Initiatives*. https://www.whitehouse.gov/administration/eop/ceq/initiatives/resilience.

Thomas, Jane and Zoe Johnson, Editors. 2008. “Comprehensive Strategy for Reducing Maryland’s Vulnerability to Climate Change: Phase I: Sea-Level Rise and Coastal Storms.” *Report of the Maryland Commision on Climate Change Adaptation and Response Working Group*.

Tschakert, Petra, Kathleen Dietrich, Ken Tamminga, Esther Prins, Jen Shaffer, Emma Liwenga, and Alex Asiedu. 2014. “Learning and Envisioning under Climatic Uncertainty: An African Experience.” *Environment and Planning A* 46 (5): 1049–67. doi:10.1068/a46257.

Turner, B. L., Roger E. Kasperson, Pamela A. Matson, James J. McCarthy, Robert W. Corell, Lindsey Christensen, Noelle Eckley, et al. 2003. “A Framework for Vulnerability Analysis in Sustainability Science.” *Proceedings of the National Academy of Sciences of the United States of America* 100 (14): 8074–79. doi:10.1073/pnas.1231335100.

U.S. Census Bureau. 2015. “American FactFinder - Results.” *Community Facts*. http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF.

U.S. Department of Health and Human Services. 2014. “One Version of the [U.S.] Federal Poverty Measure.” *2014 Poverty Guidelines | ASPE*. https://aspe.hhs.gov/2014-poverty-guidelines.

U.S. EPA. 2015. “Chesapeake Bay TMDL Fact Sheet.” *REG 03 WPD*. http://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-fact-sheet.

U.S. Fish and Wildlife Service Chesapeake Bay Field Office. 2016. “Adding to the Deal Island Wildlife Management Area Wetlands.” *On the Wild Side! E-Newsletter* --. http://www.fws.gov/chesapeakebay/newsletter/Spring09/Wicomico/Wicomico.htm.

van Maanen, John. 1988. *Tales of the Field*. *Tale*. doi:10.2307/590904.

Vayda, Andrew Peter, and Bradley B. Walters. 2011. *Causal Explanation for Social Scientists: A Reader*. Lanham: AltaMira Press. https://books.google.com/books/about/Causal_Explanation_for_Social_Scientists.html?id=OkQCTwEACAAJ&pgis=1.

Walker, Brian, Stephen Carpenter, John Anderies, Nick Abel, Graeme Cumming,

Marco Janssen, Jon Norberg, Garry D Peterson, and Rusty Pritchard. 2002. "Resilience Management in Social-Ecological Systems : A Working Hypothesis for a Participatory Approach." *Conservation Ecology* 6 (1): 1–17.

Walker, Brian, Lance Gunderson, Ann Kinzig, Carl Folke, Steve Carpenter, and Lisen Schultz. 2006. "A Handful of Heuristics and Some Propositions for Understanding Resilience in Social-Ecological Systems" 11 (1).

Walker, Brian, and David Salt. 2006. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*. Washington: Island Press. https://books.google.com/books?hl=en&lr=&id=NFqFbXYbjLEC&pgis=1.

———. 2012. *Resilience Practice: Building Capacity to Absorb Disturbance and Maintain Function*. Island Press. https://books.google.com/books/about/Resilience_Practice.html?id=LAEBev5Ljr8C&pgis=1.

Wallace, Adam. 1861. *The Parson of the Islands; a Biography of the Rev. Joshua Thomas*. *Author Published*. Philadelphia. https://archive.org/details/parsonofislandsb00wall.

Warner, William W. 1977. *Beautiful Swimmers: Watermen, Crabs, and the Chesapeake Bay*. Penguin Books. https://books.google.com/books/about/Beautiful_swimmers.html?id=BVYRAAAAYAAJ&pgis=1.

Weichselgartner, Juergen, and Ilan Kelman. 2014. "Geographies of Resilience : Challenges and Opportunities of a Descriptive Concept." *Progress in Human Geography* 39 (3): 249–67. doi:10.1177/0309132513518834.

Wennersten, John R. 1992. *Maryland's Eastern Shore: A Journey in Time and Place*. Tidewater Publishers. https://books.google.com/books?id=k_gMAAAAYAAJ&pgis=1.

West, Paige. 2005. "Translation, Value, and Space: Theorizing an Ethnographic and Engaged Environmental Anthropology." *American Anthropologist* 107 (4): 632–42. doi:10.1525/aa.2005.107.4.632.

Wheatley, William. 2004. *Deal Island History*. Deal Island, MD.

White House. 2016. "President Obama's Plan to Fight Climate Change." *Briefing Room: Climate Change*. https://www.whitehouse.gov/climate-change.

Young, Oran R. 2010. "Institutional Dynamics: Resilience, Vulnerability and Adaptation in Environmental and Resource Regimes." *Global Environmental Change* 20 (3). Elsevier Ltd: 378–85. doi:10.1016/j.gloenvcha.2009.10.001.